THE OPINION OF KWAZULU-NATAL DIETICIANS REGARDING THE USE OF A WHOLE FOODS PLANT BASED VEGAN DIET IN THE MANAGEMENT OF NON-COMMUNICABLE DISEASES

By

Laura Janse Van Rensburg

Bachelor of Science in Dietetics, Post Graduate Diploma in Dietetics

(UKZN)

Dissertation submitted in fulfilment of the requirements for the degree of

MASTER OF SCIENCE IN DIETETICS

Dietetics and Human Nutrition

School of Agricultural, Earth and Environmental Sciences

College of Agriculture, Engineering and Science

University of KwaZulu-Natal

Pietermaritzburg

March 2018

ABSTRACT

Introduction: A whole foods plant based vegan diet (WFPBVD) is one that promotes the intake of fruit, vegetables, wholegrains, nuts and seeds. To date, many international studies have investigated a WFPBVD's effect on non-communicable diseases (NCDs) mainly obesity, type 2 diabetes, cholesterol and heart disease. The positive outcome of these studies has resulted in some international doctors turning to a WFPBVD as a treatment method. South Africa is transitioning from infectious to NCDs such as heart disease, cancers, chronic respiratory disease and diabetes which are currently presenting a threat to health and development. Most of these NCDs can be reduced by eliminating the risk factors associated with them. Studies have shown that adopting a WFPBVD is beneficial in both the prevention and the treatment of NCDs. Dieticians are experts in the field of nutrition and therefore it was imperative to gather their opinion of this diet to assess whether they consider is a suitable treatment option for the prevention of NCDs.

Aim: To determine whether dieticians would use a WFPBVD to address NCDs by assessing their opinion toward the benefits and barriers of this diet.

Objectives: To determine the dieticians knowledge and attitude of a WFPBVD including definitions and use of the diet in practice; to determine the opinion toward the perceived benefits and barriers of the diet including health and personal benefits, information availability and personal barriers.

Methods: A cross-sectional study was conducted on KZN dieticians registered with the Association for Dieticians in South Africa. The study involved the use of an online survey questionnaire consisting of four parts.

Results: The study was completed by 101 dieticians of which 95% were female and 5% were male. Respondents were predominantly White (71.3%, n=72) followed by Black African (18.8%, n=19) with the lowest response rate from the Indian (9.9%, n=10) population. Most of the subjects obtained their qualification from the University of KwaZulu-Natal (66.3%). The sample was represented by 44.6% (n=45) of government employed dieticians and 47.5% (n=48) of private practicing dieticians (PPDs). Government dieticians were significantly more likely to be referred patients with cancer, non-communicable diseases (NCDs), HIV/AIDS and TB, liver

disease and renal disease compared to non-government dieticians. All but one dietician was familiar with the term vegan and 52% of the sample was familiar with the term 'whole foods plant based diet'. There was significant agreement that a vegan diet could be nutritionally adequate ($p<0.011$), but insignificant agreement that a vegan diet made up whole plant based foods could be nutritionally adequate. Subjects reported that training on a PBD at university level was inadequate however a significant sample ($p<0.05$) was confident in prescribing a PBD in practice and interested in improving their knowledge on this topic. The strongest perceived benefits of a WFPBVD reported were "It is associated with an improved fibre intake", "It encourages a lower saturated fat intake due to reduced animal products" and "it is associated with reduced risk of constipation". There was disagreement with the statements "It is an easy diet to follow" and "It is a suitable option in low-income households". The strongest barrier reported to prescribing a WFPBVD were, "There is not enough awareness around whole food plant based vegan diets for the public" and "People prefer to consume meat and animal by-products".

Conclusion: While dieticians felt that they did not receive adequate training on a PBD at university level, they did report confidence in prescribing this type of meal plan and interest in learning more about this topic. Using a WFPBVD in the treatment and prevention of NCDs is a topic that has been studied on an international level but not yet on a national level. NCDs were reported as a major reason for referral in both government and non-government dieticians and therefore this diet could be a potential treatment option. Dieticians however did not feel that this lifestyle would be suitable in low income communities which may be an interesting topic for future research. Barriers in this study included lack of public awareness about this lifestyle as well as resistance to changing current dietary habits. However, the health benefits of a WFPBVD were seen as being significantly more important than the personal benefits of this diet. Dieticians are at the forefront of nutritional communication to the public. Developing platforms to provide more training and learning opportunities to health care providers and the public on a WFPBVD may be beneficial.

PREFACE

The work described in this dissertation was carried out in the School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, from February 2017 to March 2018, under the supervision of Dr Nicola Wiles.

Signed:_____ Date: _____

Laura Janse Van Rensburg

As supervisor of this candidate, I agree to the submission of this dissertation.

Signed:_____Date: _____

Dr Nicola Wiles (Supervisor)

DECLARATION OF ORIGINALITY

I, Laura Janse Van Rensburg, hereby declare that:

i. The research reported in this dissertation, except where otherwise indicated, is my original research.

ii. This dissertation has not been submitted for any degree or examination at any other university.

iii. This dissertation does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from those persons.

iv. The dissertation does not contain other authors' writing unless specifically acknowledged as being sourced from other authors. Where other written sources have been quoted, then:

a. Their words have been rewritten but the general information attributed to them has been referenced;

b. Where their exact words have been used, their writing has been placed inside quotation marks, and referenced.

c. This dissertation does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the dissertation and in the Reference section.

Signed: ……. Date: ……

Laura Janse Van Rensburg (candidate)

ACKNOWLEDGEMENTS

I would like to express my extreme gratitude to the following people who have assisted me throughout the period of this study:

To my supervisor, Dr Nicola Wiles, you have been invaluable to the completion of this project. From the words of encouragement, the laughter when I wanted to cry, the quick responses to emails and the patience you showed on a continuous basis, I cannot thank you enough. There were many moments when I doubted the timeline of this project but your positivity swayed those negative thoughts into positives.

To my statistician, Dr Gill Hendry, thank you for your time, advice, reviewing of documents and assistance in understanding what felt essentially like a new language to me. I could not have completed this without your assistance.

To all my family and friends that showed interest and encouraged me to keep going on a daily basis, thank you for being there. Matt, Rhain and Astrid, thank you for the time off, for picking up my slack, for the coffees and snacks, and for believing in me and supporting my passion. Without the three of you this journey would have been a whole lot harder.

TABLE OF CONTENTS

CONTENTS **PAGE**

ABSTRACT……ii

PREFACE……..iv

DECLARATION OF ORINGINALITY……v

ACKNOWLEDGEMENTS……...vi

TABLE OF CONTENTS……..vii

LIST OF TABLES……xii

LIST OF FIGURES……..xiii

APPENDICES……xiv

CHAPTER 1: INTRODUCTION, THE PROBLEM AND ITS SETTING…….....1-12

1.1 The importance of the study.....1

1.2 Statement of the problem 5

1.3 Research objectives 6

1.4 Hypotheses 6

1.5 Definition of terms 6

1.6 Abbreviations.....10

1.8 Assumptions..... 11

1.9 Summary.....11

1.10 Dissertation overview..... 12

1.11 Referencing style..... 12

CHAPTER 2: REVIEW OF THE RELATED LITERATURE.....13-57

2.1 Overview.....13

2.2 Introduction to non-communicable diseases.....13

2.2.1 Behavioural risk factors..... 13

2.2.2 Metabolic risk factors..... 14

2.3 The nutrition transition.....15

2.3.1 Changes in dietary habits..... 16
2.3.2 Changes in the nutrition transition..... 18
2.3.3 Obesity trends and NCDs in South Africa..... 18
2.4 The impact of NCDs in KZN.....20
2.5 Managing NCDs and the potential use of a WFPBVD.....23
2.6 Current dietary guidelines..... 24
2.7 The history of past and present dietary patterns..... 26
2.7.1 The Paleolithic diet..... 26
2.7.2 The traditional Japanese diet..... 27
2.7.3 The Mediterranean diet.....28
2.7.4 Changes to traditional diets..... 28
2.7.5 The Blue Zones..... 29
2.8 Definition of a Plant Based Diet..... 30
2.8.1 The history of vegetarian nutrition..... 31
2.8.2 Plant based diets in practice..... 31
2.8.3 Nutritional adequacy of a PBD..... 35
2.9 Health effects of a PBD..... 42
2.9.1 The role of vegetarian diets in CVD..... 42
2.9.2 The role of vegetarian diets in weight loss and BMI..... 44
2.9.3 The role of vegetarian diets in Type 2 diabetes..... 46
2.10 Perceived benefits and barriers of a PBD in dietetic practice..... 48
2.10.1 Perceived benefits.....49
2.10.2 Perceived barriers.....50
2.10.3 Barriers to dietary and behaviour change.....51
2.11 The influence of nutrition knowledge on dietary behaviour..... 52
2.12 Can attitude and opinion of healthcare providers influence change?.....54
2.13 The role of the dietician in practice..... 55

2.14 Sustainable diets..... 55
2.15 Summary..... 56
CHAPTER 3: METHODOLOGY..... 58-76
3.1 Study design..... 58
3.2 Study setting.....58
3.3 Type of study.....58
3.3.1 Cross sectional study..... 58
3.3.2 The use of a questionnaire..... 58
3.4 Study population and sample selection..... 63
3.4.1 Study population..... 63
3.4.2 Sample selection..... 64
3.5 Questionnaire development.....64
3.5.1 Section A of the questionnaire..... 65
3.5.2 Section B of the questionnaire..... 66
3.5.3 Section C and D of the questionnaire.....69
3.6 Pilot Study..... 72
3.7 Data capturing and analysis..... 72
3.8 Data quality control..... 74
3.8.1 Validity and reliability..... 74
3.8.2 Content validity..... 75
3.8.3 Reliability..... 75
3.9 Reduction of bias..... 75
3.10 Ethical considerations..... 76
3.11 Summary..... 76
CHAPTER 4: RESULTS..... 77-87
4.1 The response rate and demographics of the population..... 77
4.2 Area of employment and patient interactions.....78

4.3 Knowledge and attitude regarding a WFPBVD..... 80
4.3.1 Plant based definitions and nutritional adequacy..... 80
4.3.2 University training and prescription in practice 82
4.4 Opinion regarding a WFPBVD.....83
4.4.1 Perceived benefits of a WFPBVD..... 83
4.4.2 Perceived barriers of a WFPBVD..... 85
4.5 Summary of results..... 86
CHAPTER 5: DISCUSSION..... 88-99
5.1 The response rate and demographic characteristics of the population..... 88
5.2 Area of employment and patient interactions..... 89
5.3 Knowledge and attitude regarding a WFPBVD..... 89
5.3.1 Plant based definitions..... 89
5.3.2 Prescription in practice..... 91
5.4 Opinion regarding a WFPBVD.....93
5.4.1 Perceived benefits of a WFPBVD..... 93
5.4.2 Perceived barriers of a WFPBVD..... 94
5.5 Summary..... 99
CHAPTER 6: CONCLUSION AND RECOMMENDATIONS…….100-105
6.1 Introduction..... 100
6.2 Conclusions of the study.....100
6.2.1 Knowledge and attitude regarding a WFPBVD.....100
6.2.2 Opinion regarding a WFPBVD.....101
6.3 Study limitations.....101
6.4 Recommendations based on the results of the study.....102
6.4.1 Recommendations for dietetic practice.....102
6.4.2 Undergraduate training for dieticians.....103
6.4.3 Research involvement of dieticians.....103

6.4.4 Recommendations for government.....103
6.5 Recommendations for future research.....104
REFERENCES..... 106

LIST OF TABLES

Table 2.1: Risk factors and their measurements for diagnosis of metabolic syndrome..... 15

Table 2.2: Top three causes of death in 2015 according to district in KZN.....22

Table 2.3: The Vegan Plate. Daily Plan for Healthy Eating..... 33

Table 2.4: Food group and recommended servings per day. A Physicians Guide..... 34

Table 2.5: Studies assessing the nutritional adequacy of the vegetarian eating pattern..... 37

Table 2.6: Factors influencing food choice..... 52

Table 3.1: Advantages and disadvantages of different survey types..... 61

Table 3.2: South African studies used to design demographics of the questionnaire..... 66

Table 3.3: Studies used for measuring dieticians' knowledge and attitudes..... 67

Table 3.4: Studies used for the benefits of a WFPBVD section of the questionnaire..... 70

Table 3.5: Studies used for the barriers of a WFPBVD section of the questionnaire..... 72

Table 3.6: Data analysis of the objectives..... 74

Table 4.1: Universities attended and qualifications of the study sample..... 78

Table 4.2: The mean frequency of adult referral reasons according to area of employment. 79

Table 4.3: Reported analyses of minimally processed whole plant based foods..... 82

Table 4.4: Subjects' agreement and disagreement regarding the perceived benefits of a WFPBVD..... 84

Table 4.5: Pattern Matrix for the benefits of a WFPBVD..... 85

Table 4.6: Analysis of the perceived barriers of a WFPBVD..... 86

LIST OF FIGURES

Figure 2.1: Illustration of The Vegan Plate Guide for healthy eating..... 32

Figure 4.1: Identification of minimally processed plant based foods by sample..... 81

LIST OF APPENDICES

Appendix A: Questionnaire.....122

Appendix B: Ethical clearance..... 131

Appendix C: Gatekeepers permission..... 132

Appendix D: Consent information sheet..... 133

Appendix E: Declaration of understanding..... 135

CHAPTER 1: INTRODUCTION, THE PROBLEM AND ITS SETTINGS

1.1 The importance of the study

Major shifts in dietary and physical activity patterns are being noted across the world in varying degrees. According to Popkin (2006), the pace of dietary change has accelerated to varying degrees in different regions of the world. This shift has been termed the "nutrition transition" and could be leading a vast majority of the world's population to a diet that is linked with non-communicable diseases (NCDs) namely heart disease, diabetes, obesity and hypertension. The term NCDs is interchangeable with the term chronic diseases of lifestyle. According to Popkin, Adair and Wen (2012), a traditional western diet, which is broadly defined by a high intake of refined carbohydrates, added sugars, fats, and animal-source foods, is the driving force behind the transition.

A plant based diet (PBD) by definition is a diet low or absent in animal products, low in fat and cholesterol and high in fibre. By replacing the current eating trends with more plant based foods it could then be possible that this would decrease the rapid rise in NCDs that the world is currently experiencing.

In many developing countries the increased rate of the nutrition transition has resulted in a rapid increase in overweight and obesity. According to Sans and Combris (2015), economic development and urbanisation has resulted in the increase of animal based protein consumption from 61 g per day in 1961 to 80 g per day in 2011. This increase has resulted in the movement away from traditional plant protein sources which once formed the bulk of many traditional diets.

In South Africa, the burden of NCDs is high (Van Zyl, Van der Merwe, Walsh, Groenewald & van Rooyen 2012). According to Vorster, Badham & Venter (2013), South Africa is experiencing a double burden of disease. This is characterised by food insecurity and undernutrition in some segments of the population and overweight and obesity due to overnutrition in other segments, sometimes even occurring in the same households. This increase in obesity puts the population at a higher risk for the development of hypertension and diabetes which continue to be in the rise in the top 10 leading causes of death (Puoane, Steyn, Bradshaw, Laubscher, Fourie, Lambert & Mbananga 2002; Statistics South Africa 2015). During the years

2010 to 2014, the gap between causes of death from communicable versus NCDs increased. More deaths were noted as a result of NCDs. In 2014, the total number of deaths from communicable diseases in South Africa was 36.8% while that from NCDs was 52.7%. According to the South African National Health and Nutrition Examination Survey (SANHANES-1)[1], identifying risk factors that are associated with NCDs is essential to the development of strategic plans to prevent and control their increasing incidences.

According to Leitzmann (2014), early human food cultures were plant based and many major religions such as Hinduism and Buddhism have all recommended a vegetarian way of life since their conception. Traditional Asian and Mediterranean diets were largely based on plant foods and data from these regions indicate that these populations have the lowest rates of diet-disease risk (Leitzmann 2014). According to Sabaté (2003), scientific evidence resulted in a paradigm shift where well-balanced vegetarian diets were viewed more as improving health than as causing disease, in contrast with meat-based diets.

According to Leitzmann (2014), a timeline in relation to vegetarianism exists. This timeline includes the progression of science from presenting a vegetarian diet as deficient in nutrients to a diet that has many health benefits. In the 1960's and 1970's, a population following a vegetarian diet was thought to be at a higher risk for developing a nutritional deficiency. This model was based on countries with widespread malnutrition and not on Asian countries that had been living successfully on vegetarian diets for many years. Therefore this belief was not entirely accurate (Leitzmann 2014). During the 1980's and 1990's, more and more studies began to document the benefits of a plant-based diet, especially in relation to NCDs. Increased mortality and longevity were attributed to a larger variety of plant foods and the absence of meat. Today, a large increase in the amount of vegetarians has been seen which is largely related to health concerns but also to ethical, environmental, and social concerns (Leitzmann 2014).

[1] Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Parker W, Maluleke T, Mchunu G, Naidoo P, Davids YD, Mokomane Z, Onoya D (2013). The South African National Health and Nutrition Examination Survey (SANHANES-1). Cape Town: HSRC Press. For the purpose of this dissertation it will be referred to as SANHANES-1.

Statements from various dietetic associations around the world state similar conclusions regarding well-planned vegetarian diets. The Irish Nutrition and Dietetic Institute noted that appropriately planned vegetarian diets could be nutritionally balanced and suitable for all stages of life (INDI 2016). Similarly, the Dieticians Association of Australia stated that vegetarian diets could be healthy if properly planned to ensure that all nutrients required are met (DAA 2016).

In 2003, the American Dietetic Association and Dietitians of Canada released a position statement stating: "It is the position of the American Dietetic Association and Dietitians of Canada that appropriately planned vegetarian diets are healthful, nutritionally adequate, and provide health benefits in the prevention and treatment of certain diseases (Messina, Melina & Mangels 2003)." Thirteen years later in 2016, the American Academy of Nutrition and Dietetics released the following statement regarding vegetarian diets: "It is the position of the Academy of Nutrition and Dietetics that appropriately planned vegetarian, including vegan, diets are healthful, nutritionally adequate, and may provide health benefits for the prevention and treatment of certain disease. Vegetarians and vegans are at reduced health risk of certain health conditions, including ischemic heart disease, type 2 diabetes, hypertension, certain types of cancer, and obesity" (Melina, Craig & Levin 2016).

South Africa uses food-based dietary guidelines (FBDGs) to encourage a diet that is adequate, meets nutritional needs and lowers the risk of NCDs (Vorster 2013). One of the guidelines states that "Fish, chicken, lean meat and eggs can be eaten daily", yet it is the overconsumption of these foods and other red meats that are associated NCDs (Schonfeldt, Pretorius & Hall 2013). This is in relation to the fat versus health debate where animal sourced foods supply nutrients that are less than desirable in the diet such as saturated fats and cholesterol. As stated with the nutrition transition, as populations urbanise, there is an increased intake of these foods and therefore an increased need to educate the public on nutritional concerns of excess intake (Schonfeldt *et al* 2013).

Another guideline states "Have milk, maas or yoghurt everyday", despite the fact that lactose intolerance is highly common passed weaning age and that dairy products are high in saturated fats (Davis & Melina 2014, p183; Vorster, Wenhold, Wright, Wentzel-Viljoen, Venter & Vermaak 2013). While these concerns have been addressed by Vorster *et al* (2013), the guideline

is justified by studies that have shown some protective effects of dairy against NCDs and the importance of calcium and potassium in the diet.

Apart from the FBDGs that promote the consumption of animal products and by-products, there are guidelines that promote the basics of a PBD. These guidelines include:

- "Make starchy foods part of most meals". In particular carbohydrates that are minimally processed such as whole grains, legumes and root vegetables (Vorster 2013).
- "Eat dry beans, split peas, lentils and soya regularly". This guideline comes with the recommendation that nutritionists should aggressively encourage consumers to consume more legumes due to their protective properties against NCDs (Venter, Vorster, Ochse & Swart 2013).
- "Eat plenty of vegetables and fruit every day". From available evidence, interventions that aim to improve vegetable and fruit intake in South Africa have the potential to contribute to a reduction in nutrition-related disease (Naude 2013).

Although animal sourced food is not an essential part of the human diet, it continues to be a popular and desirable choice with negative consequences when eaten in excess (Scholfield *et al* 2013). A PBD is also otherwise known as a vegan diet as it excludes animal products from the diet. Characteristics of this diet include a low intake of saturated fats and a high intake of vegetables, fruits, whole grains, legumes, nuts and seeds and soy products (Melina *et al* 2016). There is a lack of South African related literature regarding PBDs, yet in a culture striving to keep up with western civilisation it is essential to design dietary policies that provide solutions to our health epidemic that are affordable, sustainable and protective against NCDs. For the purpose of this study the term "plant based diet" will be referred to as a whole-foods plant based vegan diet (WFPBVD). This is because some vegan diets may be high in processed foods and may lack the health benefits of a diet based solely on whole plant based foods. Distinguishing between the two terms is essential for the purpose of this study.

As health care providers on the front line of food and nutrition recommendations, it is the responsibility of dieticians to promote health and well-being while keeping up to date with scientific evidence. With increasing numbers of deaths related to NCDs, international research continues to find a diet that can prevent and treat chronic disease. According to the Health

Professionals Council of South Africa (HPCSA), the purpose of the nutrition professional is to use appropriate policies, programmes and nutrition principles to prevent, treat and manage nutrition related diseases (Wentzel-Viljoen 2016). The scope of a dietician includes applying evidence-based food and nutrition principles in practice; as well as applying information, communication and education to empower individuals and communities. In order to maintain and enhance the quality of practice in the dietetic profession, measuring opinion on emerging scientific related nutrition topics may encourage and support expansion of knowledge of the professional. In this instance, measuring the dieticians' opinion toward a WFPBVD may encourage further research by the dietician into the topic. This research, based on the professional opinion, may therefore promote the possible use of the diet in the management of NCDs. Understanding the reasons for adopting a vegetarian diet or resuming a meat eating diet is important for clinicians as a PBD can only be clinically useful if they are acceptable to patients (Barnard, Scialli, Turner-McGrievy & Lanou 2004).

From the information presented, it is therefore pertinent that the following questions are addressed:

- Are dieticians familiar with definitions associated with a WFPBVD?
- Do dieticians consider a WFPBVD to be nutritionally adequate?
- What are the individual health and personal benefits associated with a WFPBVD?
- What are the public awareness, health and personal barriers associated with a WFPBVD?
- Will the benefits and barriers associated with a WFPBVD influence its use in the treatment of NCDs?

1.2 Statement of the problem

The nutrition transition has resulted in an increased consumption of foods that may increase the risk of NCDs as cultures around the world have deviated from predominant plant based diets to omnivorous patterns. In South Africa, there is a pattern of increasing numbers of deaths from NCDs which are largely lifestyle related and can be prevented through dietary intervention. In 2015, NCDs formed 60% of the top ten natural causes of death which is an increase from 52.7% in 2014. Females are more affected by NCD related deaths with 62.5% being affected and 48% affecting males (Statistics SA 2017a). Research has shown that a diet based on natural grains,

fruits, vegetables, nuts and seeds has been beneficial in the treatment of NCDs but some current evidence shows that removing animal sourced foods can further benefit health.

Investigating the knowledge, attitude and opinion of dieticians toward the use of a WFPBVD is important to determine whether this dietary lifestyle would be accepted as a treatment option for NCDs in South Africa.

The aim of the study was therefore to determine whether dieticians would use a WFPBVD to prevent and treat NCDs by measuring knowledge, attitude and opinion toward the benefits and barriers of the diet.

1.3 Research objectives

The objectives of this study were to investigate the following from KwaZulu-Natal (KZN) dieticians.

1.3.1 To determine the dieticians' knowledge and attitude toward a WFPBVD.

1.3.2 To determine the dieticians' opinion toward the perceived benefits and barriers of a WFPBVD.

1.4 Hypotheses

The following alternate hypotheses were predicted:

1.4.1 Dieticians would have a good level of knowledge regarding a WFPBVD.

1.4.2 Dieticians would agree with the benefits and barriers associated with a WFPBVD.

1.5 Definition of terms

Attitude:	This study assessed attitude by addressing preparedness, interest and use of a WFPBVD in practice.
Barriers:	For the purpose of this study, barriers reflect the public awareness, personal health and social aspects of adopting a WFPBVD for the patient.

Benefits:	The benefits used in this study refer to the health and personal benefits of adopting a WFPBVD for the patient.
Body Mass Index:	Simple index of weight-for-height that is used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his height in metres (WHO 2018).
Cardiovascular disease:	Cardiovascular disease (CVD) is an umbrella term for a number of linked pathologies commonly defined as coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic and congenital heart disease and venous thrombolism (Stewart, Manmathan & Wilkonson 2017).
Diabetes:	Chronically elevated blood sugar levels due to insufficient production of insulin by the pancreas or because the body is resistant to insulin's effects (Greger 2016, p100).
Food-based dietary guidelines:	Brief, positive dietary recommendation messages that are used to inform consumers how to choose food and beverages that will lead to a diet that is adequate, meets nutritional needs and lowers the risk of noncommunicable diseases (Vorster 2013).

Mediterranean diet:	A dietary pattern rich in plant foods (cereals, fruits, vegetables, legumes, tree nuts, seeds and olives), with olive oil as the principal source of added fat, along with moderate consumption of eggs, poultry and dairy products (cheese and yoghurt), low consumption of red meat and a moderate intake of alcohol (mainly wine during meals) (Bach-Faig, Berry, Lairon, Reguant, Trichopoulou, Dernini, Medina, Battino, Belahsen, Miranda & Serra-Majem 2011).
Non-communicable diseases:	A collective name for diseases caused by changes in diet and lifestyle. Namely type 2 diabetes, obesity, hypertension and cardiovascular disease (Konner & Eaton 2012).
Nutrition Transition:	The change in food and beverage purchasing practices as well as a reduction in physical activity that have resulted in an increase of NCDs. The transition refers to the migration from traditional eating patterns to the adoption of a typical western diet (Popkin *et al* 2012).
Overweight and Obesity:	Defined as abnormal or excessive fat accumulation that may impair health. Overweight is a BMI greater than or equal to 25kg/m² and obesity is defined as a BMI greater than or equal to 30kg/m² (WHO 2018).

Pesco-vegetarian:	Does not contain meat or poultry but does contain fish and shellfish, eggs, and dairy, in addition to plant based foods, such as fruits, vegetables, wholegrains and beans/legumes (Turner-McGrievy, Davidson, Wingard, Wilcox & Frongillo 2015).
Plant based diet:	An eating pattern that encourages the consumption of unrefined plant foods such as fruit, vegetables, whole grains, beans/legumes, nuts and seeds, and discourages meats, dairy products, eggs and processed foods (Greger 2016, p10).
Prudent diet:	A diet that promotes fruits, vegetables, whole grains, nuts, low-fat dairy product and limits red and processed meats (Vorster 2013).
Semi-vegetarian:	A diet including meat, poultry, fish and shellfish, eggs, and dairy, in addition to plant based foods. However red meat and poultry are limited (Turner-McGrievy *et al* 2015).
Vegetarian:	A diet that does not contain meat, fish or poultry but includes eggs and dairy in addition to plant based foods such as fruits, vegetables, whole grains and beans/legumes (Turner-McGrievy *et al* 2015).
Vegan:	A diet that does not contain any animal products (meat, fish, poultry, eggs, or dairy) but emphasises plant based foods such as fruits, vegetables, whole grains and beans/ legumes (Turner-McGrievy *et al* 2015).

Western diet:	Broadly defined by a high intake of refined carbohydrates, added sugars, fats and animal-source foods (Popkin, Adair & Ng 2012).
Whole foods plant based vegan diet:	For the purpose of this study this is a diet that excludes animal products and consists of a high intake of vegetables, fruits, whole grains, legumes, nuts and seeds.

1.6 Abbreviations

ADSA: Association for Dieticians in South Africa

BMI: Body Mass Index

CPD: Continuing Professional Development

CVD: Cardiovascular Disease

DM: Diabetes Mellitus

FBDG: Food Based Dietary Guidelines

HCLF: High Carbohydrate Low Fat

HPCSA: Health Professions Council of South Africa

IDF: International Diabetes Federation

KZN: KwaZulu-Natal

LCHF: Low Carbohydrate High Fat

MDS: Mediterranean Dietary Score

NCD: Non-communicable Disease

PBD: Plant Based Diet

PURE study: Prospective Urban and Rural Epidemiological study

RD: Registered Dietician

SA: South Africa

TB: Tuberculosis

THUSA study: Transition and Health during Urbanisation of South Africans study

WFPBVD: Whole Food Plant Based Vegan Diet

WHO: World Health Organisation

1.7 Assumptions

For the purpose of this study, the following assumptions were made:

- All dieticians would be up to date with their Continuing Professional Development (CPD) points as outlined by the Health Professions Council of South Africa (HPCSA) as this practice ensures continuous updated knowledge and skills for the health practitioner.
- All dieticians registered with ADSA had internet access and read their weekly newsletter.
- All dieticians would complete the questionnaire honestly and accurately.
- Dieticians would be familiar with the term WFPBVD.

1.8 Summary

A worldwide migration away from traditional eating patterns towards a diet high in saturated fats, sugars, animal products and processed foods has resulted in an increase of NCDs. In South Africa, statistics have shown that death from Type 2 diabetes and coronary heart disease is on the incline. Internationally, emerging evidence has shown that PBDs are important in the treatment and prevention of NCDs but to date this topic has not been studied in South Africa. As diet is a major contributing factor to the development of NCDs, it is essential that dieticians keep up to date with scientific research and continue to update professional knowledge on nutrition guidelines. It is anticipated that the results of this study will contribute toward providing up to date information regarding the personal opinion of registered dieticians towards a WFPBVD. The term WFPBVD was used rather than PBD in this study to ensure dieticians understood that this diet was completely free of animal products and by-products.

1.9 Dissertation Overview

This dissertation is made up of six chapters. The first chapter provides information on the importance of the study and the relevance of the study in light of current dietary practices. Chapter two addresses the current literature relating to the research topic and objectives. The third chapter details the methodology used in the study and the fourth chapter presents the results following statistical analyses of that data. The fifth chapter discusses the results of the study in relation to the literature presented in chapter two. Chapter six outlines the conclusions obtained from the study along with recommendations for further research.

1.10 Referencing Style

This dissertation has been written using the referencing style employed by the Discipline of Dietetics & Human Nutrition, University of KwaZulu-Natal.

CHAPTER 2: REVIEW OF THE RELATED LITERATURE

2.1 Overview

This chapter will present the literature that looks at NCDs and the risk factors associated with them. It will address the metabolic syndrome and the nutrition transition that has occurred around the world and in South Africa in particular. Current dietary guidelines and an insight into past and present eating patterns will be discussed which will lead into the definition of a PBD and the background information to this eating pattern. The health effects of a PBD in connection to cardiovascular disease, weight loss and type 2 diabetes will be addressed in detail looking at older and more recent literature. The perceived benefits and barriers of using a PBD in dietetic practice including the barriers to behaviour change and the role of the dietician in practice will be presented. This chapter will close with a brief look into sustainable diets and what this means for future dietetic practice.

2.2 Introduction to non-communicable diseases

Non-communicable diseases are a group of conditions that have resulted in an increase in deaths worldwide and many of them are self-caused (Van Zyl, Van der Merwe, Walsh, Groenewald & van Rooyen 2012). According to the World Health Organisation (WHO 2017), many of these factors are caused by an unhealthy lifestyle and can in fact be avoided, yet NCDs continue to affect people of all regions, age groups and countries. NCDs are responsible for 40 million deaths each year which is equivalent to 70% of all deaths worldwide. Cardiovascular disease (CVD), cancer, respiratory disease and type 2 diabetes account for the most deaths caused by NCDs on an annual basis. The risk factors for NCDs can be broken down into two groups, mainly modifiable behavioural risk factors, and metabolic risk factors (WHO 2017).

2.2.1 Behavioural risk factors

Behavioural risk factors include smoking, excess salt/sodium intake, excess alcohol and low levels of physical activity. Allen, Williams, Townsend, Mikkelsen, Roberts, Foster and Wickramasignhe (2017) conducted a systematic review of the associations between socioeconomic status and the behavioural risk factors. Their findings were that low socioeconomic groups in many countries were more likely to consume alcohol, use tobacco and

consume insufficient fruits and vegetables than high socioeconomic groups. The higher socioeconomic groups however tended to be more active while consuming more fats, salts and processed foods. According to SANHANES-1 (2013), 67% of the South African population reported having used some kind of tobacco product, exercise appeared to be more common in rural-based economies and alcohol intake was not perceived to be a serious problem in more than half the homes surveyed. Dietary habits in relation to food consumed however remain a concern despite household food security status being maintained (SANHANES-1, 2013).

2.2.2 Metabolic risk factors

Metabolic factors include a raised blood pressure, being overweight/ obese, hyperglycaemia (high blood sugar) and hyperlipidaemia (high fat levels in the blood). Whilst some of these risk factors may have some genetic link, most of them can be controlled by diet and behaviour modification (WHO 2017). Addressing the metabolic factors is important as lifestyle can have an effect on these factors and result in metabolic syndrome.

According to Van Zyl *et al* (2012), metabolic syndrome refers to the cluster of risk factors that increase the likelihood of developing type 2 diabetes mellitus (DM) and CVD. The general features of the metabolic syndrome include abnormal body fat distribution, insulin resistance, atherogenic dyslipidaemia, elevated blood pressure, a pro-inflammatory state (recognised by high C-reactive protein) and a prothrombotic state (Alberti & Shaw 2006). The International Diabetes Federation (IDF) states that the presence of three or more risk factors will lead to a clinical diagnosis of metabolic syndrome (Alberti & Shaw 2006). Table 2.1 presents these risk factors and the measurements used to classify risk of metabolic syndrome.

Table 2.1 Risk factors and their measurements for diagnosis of metabolic syndrome (Van Zyl *et al* 2012; Lutsey, Steffen and Stevens 2008; Alberti and Shaw 2006)

Risk factor	**Measurement**
Increased waist circumference	>88cm women or >102cm men
Elevated triglycerides	≥150mg/ dL (≥1.7mmol/l)
Reduced HDL cholesterol	<1.29mmol/l women or <1.03mmol/l men
Elevated Blood Pressure	≥130/85 mmHg
Elevated fasting glucose	≥5.6 mmol/l

Metabolic syndrome and NCDs are largely influenced by obesity. Lutsey *et al* (2008) assessed the role of diet in the origin of the metabolic syndrome and found the most frequent contributor upon diagnosis of the metabolic syndrome, was abdominal obesity. The IDF too considers obesity to be one of the highest drivers of the syndrome especially abdominal obesity which has been linked to an increase risk of developing CVD. Elevated triglycerides, blood sugar and reduced HDL cholesterol are also accentuated by weight gain (James, Rigby & Leach 2003). According to the WHO (2017) obesity and NCDs are driven by forces such as urbanisation and the globalisation of an unhealthy diet also known as the nutrition transition.

2.3 The nutrition transition

Urbanisation, the movement of populations from rural to urban areas, has resulted in the double burden of malnutrition where undernutrition and overnutrition are seen in the same households (Popkin *et al* 2012). The concept of the nutrition transition focuses on large shifts in dietary and activity patterns which in turn reflect in nutritional outcomes such as having an average stature and body composition (Popkin 2006). According to Schmidhuber and Shetty (2005), the average calorie availability in the developing world has increased from 1950 calories to 2680 calories per person per day. This is due to the shift toward the availability of higher energy food supplies, increased fats and oils, increased animal based foodstuffs and an increase in animal protein and fats (Schmidhuber & Shetty 2005).

Popkin *et al* (2012) have suggested that the large shift toward animal-source food consumption creates a major demand for basic grains to be fed to livestock. This disregards the needs of the

poor for these grains and increases the pricing of these essential staples. The adverse effects of these changes in trends has resulted in a reduction in the consumption of starchy staples, fruits and vegetables and an increase in the consumption of obesogenic, empty calorie foods (Popkin *et al* 2012; Popkin 2006). A reduction in the price of fatty foods, oils, sugar and animal source foods relative to legumes, fruits and other vegetables results in the latter becoming less desirable and less likely to be purchased and consumed (Popkin *et al* 2012).

2.3.1 Changes in dietary habits

Popkin (2003) presented reasons for the shift in eating habits that have occurred over the past decades and listed pertinent contributors to the nutrition transition. The economic theory is one such contributor and encompasses a range of factors such as the desire for a varied diet and a lighter work pattern. It is also suggested that the interaction between income and food consumption has a major role to play where any additional income may be used to purchase higher fat, convenience foods which are often cheaper than the healthier alternatives (Popkin 2003).

In South Africa these factors are supported by Vorster, Kruger and Margetts (2011), who looked at changes in dietary patterns by comparing data from 1975-2005 in two major studies. These studies included the Transition and Health during Urbanisation of South Africans Study (THUSA study) and the Prospective Urban and Rural (PURE) study. The results of these studies suggest that dietary changes to more palatable diets containing snack foods, fast and convenient foods have been clearly noted, especially with the movement into a more urban environment. Urban women were more likely to have a higher mean fat and lower mean carbohydrate intake, compared to rural women (Vorster *et al* 2011).

Isolated results from the PURE study conducted in urban and rural subjects (35 years and older) found that the movement from rural to urban areas resulted in an increased intake of total energy, fat and saturated fat, animal source protein and larger portion sizes (Pisa, Behannan, Vorster & Kruger 2012). The conclusions to this analysis showed that urban subjects had higher risk factors for CVD (Pisa *et al* 2012).

A similar pattern was reported by Bourne, Lambert and Steyn (2002) who looked at where the Black African population of South Africa featured in the nutrition transition. Those that had

recently moved into the city of Cape Town generally had a lower education status, lived in informal housing, consumed a diet low in vitamins and minerals and had low atherogenicity (fat in artery walls). However, the more urbanised Black African individuals with higher education levels and living in formal housing consumed diets higher in vitamins and minerals but also reported high levels of deposits on the artery walls. This suggests that improvements in socio-economic status can result in shifts to an inappropriate nutritional pattern that may predispose to atherosclerosis (Bourne *et al* 2002).

Among the middle to upper class population in South Africa, there is a current trend toward the consumption of a low carbohydrate, high fat diet (LCHF). Timothy Noakes, a professor and medical doctor has been the South African pioneer for the LCHF diet since publishing about the beneficial effects of a LCHF diet in the South African Medical Journal (Noakes 2013). Noakes stated that the LCHF diet is superior to the high carbohydrate, low fat (HCLF) diet generally prescribed for the treatment of NCDs (Noakes 2013). Since the release of this publication, there has been a sparked interest in adapting to this way of eating with many stores promoting LCHF products and recipe books. The common issues seen in practice with the adaptation to this lifestyle is the large increase in the consumption of animal products in favour of plant based foods such as fruits, vegetables, legumes and whole grains. The LCHF is based on ancestral behaviours dating back to the Paleolithic era where diets were in fact predominantly plant based (Konner & Boyd Eaton 2010).

Looking specifically at the nutrition transition, the quality and diversity of diet was assessed between South African and Kenyan women in accordance to weight status by Steyn, Nel, Parker, Ayah and Mbithe (2012). Kenyan women between 15 and 60 years were randomly selected from both rural and urban areas and stratified according to socioeconomic categories. Data from the 2007 Demographic and Health Survey were used to gather anthropometrics for South African women 15 years and older. All data was collected using a 24 hour recall questionnaire and measurements for weight, height and body mass index (BMI) were recorded. Total energy intake was higher in both urban and rural South African women compared to Kenyan women. Comparing to South African women's diets, Kenyan women consumed little variety in their diet, lower protein from animal products, similar carbohydrate intake and a higher intake of fruit, vegetables and legumes. From this it appears that due to the reliance on commercial

convenience/processed foods, more South African women have been exposed to the nutrition transition than Kenyan women (Steyn *et al* 2012).

2.3.2 Changes in the nutrition transition

Popkin (2003) suggests three major stages to the nutrition transition. In the first stage, "receding famine", diets were high in carbohydrates and low in fat but dietary diversity was low which resulted in low obesity levels but high micronutrient deficiency levels. Stage two, "degenerative disease", is currently being experienced and is characterised by a diet high in fat, refined carbohydrates, sugar and cholesterol and low in fibre. Obesity levels and the risk of NCDs in this stage of the transition are high as seen in both developed and developing countries. The final stage, "behavioural change", is the most important stage and needs to occur from a desire to prolong health and delay or prevent degenerative disease. In this stage, there is an increased consumption of fruit, vegetables, complex carbohydrates and fibre and a reduced consumption of fat, processed foods, meat and dairy (Abrahams, Mchiza & Steyn 2011; Popkin 2003).

2.3.3 Obesity trends and NCDs in South Africa

The African continent, until recently, has not seen a major increase in NCDs due to other infectious diseases such as HIV and tuberculosis (TB) being largely responsible for the health epidemic. However, over the last century there has been a rapid increase in overweight and obesity and their associated co-morbidities (Sartorius, Veerman, Manyema, Chola & Hofman 2015). The Body Mass Index (BMI) is a measure of nutritional status that combines weight and height. The WHO (2016) defines overweight as a BMI greater than or equal to 25kg/m² and obesity as a BMI greater than or equal to 30kg/m². Currently South Africa is undergoing a rapid transition with the highest obesity prevalence of 27% in Sub-Saharan Africa (Micklesfield, Lambert, Hume, Chantler, Pienaar, Dickie, Puoane & Goedecke 2013).

Findings of 1008 Kenyan versus 4481 South African women in terms of overweight and obesity were reported by Steyn *et al* (2012). It was found that while obesity was of growing concern in both countries, South African women were more likely to be obese with 27% versus 14.2% in South African women compared to Kenyan women respectively. In both countries, urban women had the highest prevalence of obesity. Obesity was reported in 31% of urban and 21% of rural South African women versus 15.8% of urban and 10.3% of rural Kenyans. South African women

also reported higher waist to hip ratios across every age group when compared to Kenyan women. The differences presented from this study showed that the nutrition transition is similar in both countries with an increased risk of NCDs, despite sociodemographic differences (Steyn *et al* 2012).

Data from SANHANES-1 (2013), reported a significant difference in BMI between males and females older than fifteen years. The average for men was a BMI of 23.6kg/m² (normal), while females reported an average BMI of 28.9kg/m² (overweight). The prevalence of overweight and obesity was significantly higher in females then males at 24.8% and 39.2% compared to 20.1% and 10.6% respectively (Shisana *et al* 2013). Fifteen years earlier the 1998 National Demographic and Health Survey (SADHS) reported an obesity prevalence of 30% in females compared to 7.5% in males older than fifteen years suggesting that the obesity epidemic in South Africa has increased.

Sartorius *et al* (2015) analysed three national cross-sectional surveys to identify factors associated with obesity in adults older than fifteen years of age. The surveys took place in 2008, 2010/11 and 2012 with 7273, 8600 and 9751 respondents respectively. There was a significant increase in BMI and prevalence of obesity from 26.1 kg/m² and 23.5% in 2008 and 26.8kg/m² and 27.6% in 2010/11. The survey results from 2012 showed a slight increase in BMI at 26.9kg/m² but a reduction in the prevalence of obesity at 27.2% from 2010/11. This increase in BMI could be linked to the nutrition transition with the adoption of a Western lifestyle resulting in an increased consumption of fast foods and a reduced consumption of fruits, vegetables and grains (Sartorius *et al* 2015).

A study was undertaken by Maimela, Alberts, Modjadji, Choma, Dikotape, Ntuli and Van Geertruyden (2016), in Limpopo Province to determine the prevalence of NCDs in a rural community (n=732). Behavioural risk factor information was collected using face to face interviews, along with physical measurements of blood pressure, height, weight, waist circumference, fasting glucose and cholesterol. Results showed a high percentage (38.9%) of the population with HPT that increased significantly with age in both females and males. The prevalence of overweight was reported in 27.1% of the total population with obesity being higher in females (27.8%) then males (10.6%). A high fasting glucose, reported as >7.0mmol/l was found in 12.5% of the population with a greater prevalence seen in older participants. High total

cholesterol was reported by 32.6% of the population with older men and women being at higher risk. The results from this study suggest that risk of NCDs increased with age and they were in fact major public health problems (Maimela *et al* 2016).

The obesity epidemic in South Africans reflects globalisation which is the driving mechanism of the nutrition transition (Kruger, Puoane, Senekal & Van Der Merwe 2005). There is compelling evidence of a rise in mortality and morbidity from NCDs in South Africa (Mayosi, Flisher, Lalloo, Sitas, Tollman & Bradshaw 2009).

2.4 The impact of NCDs in KZN

According to the South African Health Review report (2016), the chronic nature of NCDs imposes a burden that already exists on the healthcare system due to the HIV and AIDS epidemic and the high burden of TB. This was evident in a cross-sectional study conducted in rural KZN on 570 participants where 381 were HIV negative and 189 were HIV positive. The study was conducted to determine the incidence of HIV and NCD risk factors. Of the study sample females were more likely to be overweight and obese (BMI≥25, BMI≥30kg/m²) regardless of HIV status. In the entire sample 71.2% were overweight or obese, 3.9% had raised glucose levels (>11mmol/l) and 33.3% were hypertensive (>140/90). This high rate of NCD risk factors coupled with HIV treatment places a major burden on the economy (Van Heerden, Barnabas, Norris, Micklesfield, van Rooyen & Celum 2017).

A population based survey in rural KwaZulu-Natal was conducted between 2003 and 2004 to determine the prevalence of obesity and hypertension (>140/90mmHg) (HPT) in a community with a very high HIV positive population (n=4896). Results from this survey showed that of those measured (n=2543), 58% were overweight and 32% were obese. Those individuals who were HIV positive presented with a BMI 1.9 times lower than that of HIV negative individuals. The incidence of HPT was also high with stage I and stage II HPT being reported in 24% and 9% of the population respectively. The results from this study showed that despite the high incidence of HIV, obesity and HPT are major health concerns (Barnighausen, Welz, Hosegood, Batzing-Feigenbaum, Tanser, Herbst, Hill & Newell 2008).

Pillay, Lutge and Aldous (2016) reported on the burden of diabetes in KZN in relation to the number of defaults on medication and amputations. From records over a five year period it was

found that the number of newly diagnosed patients decreased however the number of patients defaulting was high at 3.3% and 1.8% in 2013 and 2014 respectively. As default rates increased, amputation rates increased which place a burden on the economy of the province and therefore on the country. As amputation rates increase more people are left without jobs which may result in income loss for families and complications with amputations may result in increased hospital stays which is an increased cost to the state (Pillay *et al* 2016).

According to the 2015 statistics South Africa report on mortality and causes of death, KZN has high death rates from HIV, TB, DM and cerebrovascular disease. Of the ten districts that make up the KZN province 100% have TB in the top three causes of death and 90% have one or more NCDs coupled with HIV or TB. The top three causes of death according to each district in presented in Table 2.2 (Statistics SA 2017b).

Table 2.2 Top three causes of death in 2015 according to district in KZN.

District	Cause of Death	n	%
Amajuba	Tuberculosis	428	9.0
	Other forms of heart disease	312	6.5
	Cerebrovascular disease	307	6.4
eThekwini	Tuberculosis	1576	8.5
	Other forms of heart disease	1567	8.4
	Diabetes mellitus	1295	7.0
iLembe	Tuberculosis	668	13.3
	Diabetes mellitus	377	7.5
	Cerebrovascular disease	338	6.7
Sisonke	Tuberculosis	550	10.0
	Human Immunodeficiency virus	416	7.5
	Diabetes mellitus	337	6.1
Ugu	Tuberculosis	778	9.0
	Cerebrovascular disease	600	6.9
	Diabetes mellitus	583	6.7
uMgungundlovu	Diabetes mellitus	845	8.2
	Human Immunodeficiency virus	817	7.9
	Tuberculosis	687	6.4
uMkhanyakude	Human Immunodeficiency virus	477	13.4
	Tuberculosis	311	8.7
	General symptoms and signs	241	6.8
uMzinyathi	Tuberculosis	329	7.7
	Cerebrovascular disease	314	7.4
	Other viral disease	308	7.2

Table 2.2 Continued

District	Cause of Death	n	%
uThukela	Tuberculosis	620	9.7
	Cerebrovascular disease	449	7.0
	Diabetes melitus	416	6.5
uThhungula	Tuberculosis	730	9.5
	Human Immunodeficiency virus	487	6.3
	Diabetes melitus	460	6.0
Zululand	Tuberculosis	685	11.2
	Diabetes melitus	335	5.5
	Cerebrovascular disease	328	5.4

Policies and plans that aim to reduce NCDs as well as intervention strategies that will manage patients with NCDs needs to be implemented and intensified (Pillay *et al* 2017).

2.5 Managing NCDs and the potential use of a WFPBVD

Rapidly changing food environments and the increase of NCDs resulted in the formation of a short term framework to reduce NCDs from 2013-2017 in South Africa. The plan advocated for a legislative approach to improve food environments in particular to:

- Reduce trans-fatty acids in food,
- Reduce salt in processed foods,
- Ban junk food advertising,
- Incorporate food tax on unhealthy foods (foods high in fat and sugar),
- Add subsidies on healthy foods (fruits and vegetables) and
- Better control food and nutrient supplements (Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17).

A sub-strategy of this plan stated, "Prevent NCDs and promote health and wellness at population, community and individual level." With KZN having high unemployment rates of

24.1% according to the latest quarterly report from Statistics SA (2017c), finding ways to encourage community food programmes may be beneficial to health. The plan acknowledges that education on changed behaviour cannot be successful if access to healthy food is not within reach. The shortage of fruit and vegetables and healthy low-fat foods in townships also pose a significant problem (Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17).

The legislative approach and health and wellness promotion at community level all provide open opportunities for the use of a WFPBVD in reducing NCDs. According to Galhena, Freed and Maredia (2013), home and community gardens form an integral part of local food systems and enhance household food security and nutrition. These home gardens can be described as a mixed cropping system of fruits, vegetables, plantation crops, spices and herbs. In South Africa, considering the most important crops for intervention is important to ensure micronutrient intakes are adequate. Faber, Witten and Drimie (2011), state that crop diversity is important to ensure year availability of food as well as access to a greater variety of foods. This variety can increase the nutritional profile of the diet as well as provide income to communities to harvest and sell crops at local markets.

According to Kruger *et al* (2005) it is important to focus on weight management interventions in order to promote an environment that does not encourage the consumption of foods rich in fat and high in sugar. Dietary guidelines are those which promote health and longevity, whilst simultaneously reducing the risk of diet-related chronic diseases, by offering suggestions for the consumption of an optimal diet (Sabate 2003).

2.6 Current dietary guidelines

Worldwide, dietary guidelines are used by governments to protect populations against NCDs and to promote healthy eating. The exact composition of a healthy diet may depend on individual needs, cultural context, local availability of foods and dietary customs (WHO 2015). Most guidelines worldwide are influenced by the prevailing public health problems within that country and have adapted over time according to country specific determinants. An example of this is post World War II where the US guidelines shifted from advising the daily consumption of

approximately equal servings of four food groups, to a general ‘eat more’ policy due to the poor nutritional status noted in soldiers (Nestle 1999).

In South Africa, the FBDG are used to inform consumers of food and beverage combinations that will lead to an adequate nutrient intake (Vorster 2013). These guidelines are considered prudent, which is defined as a diet that is rich in vegetables, fruit, legumes, whole grains and fish (Castro-Quezada, Roamn-Vidas & Serra-Majem 2014). The WHO (2015) states that a healthy diet that focuses on reducing NCDs should contain the following:

- Fruits, vegetables, legumes (such as lentils and beans), nuts and whole grains (unprocessed maize, oats, wheat, brown rice).
- At least 400 g or five portions of fruit and vegetables a day.
- Less than 30% of total energy intake from fat. Unsaturated fats such as those from fish, avocado, nuts and seeds and olive oil are preferable to saturated fats found in fatty meat, butter, palm and coconut oil, cream cheese, ghee and lard. Saturated fats should make up less than 10% of total fat intake.

These key recommendations from the WHO (2015) are in line with the prudent guidelines. Large organisations and dietary groups place a lot of resources and time into the development of dietary guidelines, yet the rate of NCDs remains high. According to Greger (2016), the disadvantage of guidelines are that they are very clear when the message is to ‘eat more’ but ambiguous when the message is to ‘eat less’. An example of this is seen in the South African FBDGs that state ‘Fish, chicken, lean meat, and eggs can be eaten daily’ and ‘Have milk, maas or yoghurt everyday’. While these guidelines are clear that these foods should be consumed on a daily basis, the fat guideline states ‘Use fats sparingly. Choose vegetable oils, rather than hard fats’ (Vorster 2013). This sends mixed messages to the consumer as animal fats, especially red meat and dairy products are major contributors to fat intake and an increased consumption of these foods directly results in an increased fat intake (de Oliveira Otto, Mozaffarian, Kromhout, Bertoni, Sibley, Jacobs Jr & Nettleton 2012).

Research surrounding past and traditional eating patterns in various parts of the world have shown low rates of NCDs among people living in certain communities. In particular these eating patterns include the vegetarian, Mediterranean and Japanese diets. One dietary pattern, the

Paleolithic diet, challenges the consensus that eating more plant based foods and less animal foods would best promote health (Nestle 1999).

2.7 The history of past and present dietary patterns

Paleolithic, traditional Japanese and Mediterranean dietary patterns have formed the basics of early human food cultures (Leitzmann 2014). The Paleolithic diet, which is now commonly practiced by athletes, dieters and health seekers, is a controversial diet. It differs from the Japanese and Mediterranean diet in that during the Paleolithic era, people experienced a shorter average lifespan of 33 years (Davis & Melina, 2014 p279). In contrary to this those following the Japanese diet, as well as the Mediterranean diets, have some of the oldest living people still in existence today. The areas where these dietary patterns are practiced are known as the Blue Zones and are classified as having the largest population of centenarians in the world. The common thread of all these early human food cultures is that they were and are predominantly plant based. In cultures where Japanese and Mediterranean diets are still practiced today there appears to be a low incidence of diet-related NCDs which may suggest that a diet made up predominantly of plant based foods provides additional health benefits beyond the nutrients that they provide.

2.7.1 The Paleolithic diet

According to Crittenden and Schnorr (2017), the Paleolithic or "hunter-gatherer" diet by definition is based on subsistence, where societies obtain their food and other requirements directly from wild sources. A foraging population is defined as one that consumes only 10-15% of domesticated foods. If this was applied today in the 21st century, no population would meet this criterion (Crittenden & Schnorr 2017). These pre-agricultural diets varied considerably depending on location, season, hunting and gathering skills and available tools (Davis & Melina 2014, p279). With such diverse climates experienced geographically by the early human populations it can be noted that there is no single definition for a hunter-gatherer diet. Nutrition scholars over the decades however, have argued that plant to animal ratios overplays the contributions made by animal products and downplay the significance of plant foods (Crittenden & Schnorr 2017).

Konner and Eaton (2010), state that records pertaining to the origin of our species (Homo sapiens) indicate that flexibility in adaptation may have been central to evolution, with diet composition playing a vital role in the process. The ratio of plant to animal foods may have adapted over time as our species evolved. Despite the great dietary variety noted among foraging populations, major food groups based on qualitative nutritional characteristics or species traits may have included: berries, underground vegetables (tubers), fruits, young greens, seeds and nuts, large and small mammals, game, small land fauna such as lizards and rodents, fish/shellfish, insects, larvae and honey (Crittenden & Schnorr 2017). Today, those following the Paleolithic Diet, place an exaggerated emphasis on the importance of meat in the diet and base most meals around animal products as an important fuel source. In so doing, the macro and micro-nutrient intakes of past and present Paleolithic Diets may contain many discrepancies (Davis & Melina, 2014, pp 279-278).

2.7.2 The traditional Japanese diet

According to Willcox, Willcox, Todoriki & Suzuki (2009), the Japanese population inhabiting the southernmost islands of Okinawa in particular, have been recorded as having the longest life span. While the longevity noted in Okinawa is thought to be related to a healthy lifestyle, the traditional diet plays a large role too (Willcox *et al* 2009). Characteristics of the Japanese diet include the following as presented by Willox *et al* (2009):

- High consumption of vegetables;
- High consumption of legumes (mostly of soy origin);
- Moderate consumption of fish products;
- Low consumption of meat and meat products;
- Low consumption of dairy products;
- Moderate alcohol consumption;
- Low calorie intake;
- A diet rich in omega-3 fats;
- High monounsaturated to saturated fat ratio, and
- An emphasis on the consumption of low-GI carbohydrates.

This pattern of eating among the Japanese has been associated with lower mortality rates due to low rates of CVD and certain cancers including, prostate, breast and colorectal. While the exact mechanism for the reduced cancer rates is unknown, it may be related to the high consumption of soy-derived proteins (Ogce, Ceber, Ekti & Oran 2008). According to Willcox *et al* (2009), the traditional diet has been affected by westernisation most notably through an increased fat intake and a decrease in carbohydrate quality. As a result, younger Okinawans are developing a higher risk of obesity and other chronic disease risk factors compared to the older generation.

2.7.3 The Mediterranean diet

The traditional eating pattern of the Greeks have been used to define the term Mediterranean diet due to the longer life span and lower death rate noted among this population. The diet of Crete in particular, represents the traditional diet of Greece before 1960 where lower rates of CVD were noted (Simopoulos 2001). Similar to the hunter-gatherers, the nutrient intake of the Mediterranean countries vary according to culture, availability and accessibility of food with some Middle Eastern Mediterranean and North African countries showing signs of nutritional deficiencies (Castro-Quezada *et al* 2014).

According to Castro-Quezada *et al* (2014), despite the disparity between countries, the traditional Mediterranean diet has been associated with a lower incidence of CVD, Type 2 diabetes and certain types of cancers. The diet follows a plant based pattern with a high intake of vegetables, fruits, whole grain cereals, legumes and nuts. A moderate consumption of fish and shellfish, white meat, eggs, and dairy products, and a low consumption of red meat, processed meats, and foods high in sugars and fats. The main source of dietary fats in this diet is olive oil (Castro-Quezada *et al* 2014).

According to Ogce *et al* (2008), the ideal diet should closely resemble a Mediterranean Dietary pattern, however the pattern has changed over the last 40 years due to globalisation and social change.

2.7.4 Changes to traditional diets

In 2010 the Mediterranean dietary pyramid was adjusted in order to consider the changes in lifestyle, diet, sociocultural, environmental and health that the worldwide population was facing.

The new Mediterranean guidelines encouraged a daily consumption of plant based foods including fruits, vegetables, whole grains and low fat dairy products; and a weekly consumption of fish, white meat, eggs and red meat (Bach-Faig, Berry, Lairon, Reguant, Trichopoulou, Dernini, Medina, Battino, Belahsen, Miranda & Serra-Majem 2011).

Previous Mediterranean, Japanese and Paleolithic practices avoided excessive consumption of any component of the diet, and salt, sugar, sweet desserts and animal products were less frequently consumed. Modern society today has shifted from using plant foods as the basis of all meals as was seen in the previous dietary practices (Anderson & Nieman 2016). The difference between the old and new Paleolithic diet is that the wild animals eaten in the Paleolithic era provided fewer calories from fat and were also free from hormones, antibiotics and environmental contaminants. According to Konner and Eaton (2010), primate diets on which the Paleolithic diet is based, were largely plants supplemented by insects and in some species a small amount of animal flesh. Although the current Paleolithic diet encourages the use of free-range animals, these products are less affordable and less available to the average consumer (Davis & Melina 2014, p279).

2.7.5 The Blue Zones

Although much of what is known about the Blue Zones is due to observation, the results of the people living within these communities speak volumes about health and diet practices. The Blue Zones are areas of extreme longevity, where people are seen living a healthy and active life up to and over 100 years of age (Buettner 2017). These areas include Okinawa Japan; Sardinia, Italy; Nicoya, Costa Rica; Ikaria, Greece, and Loma Linda, California. Upon further study of these areas, it was found that all these zones shared similarities in their lifestyles and diets which may have contributed towards the longer life span. With the inclusion of exercise, reduced stress and living in a close community, emphasis on diet is vital for health promotion. The Blue Zone guidelines apply a 95-5% rule where 95% of the diet should come from plant based foods and only 5% from animal products. The plant based foods include fruits, vegetables, grains, leafy green vegetables and beans with the inclusion of a handful of nuts a day and the use of olive oil

to sauté foods. The guideline suggests removing dairy and meat from the diet but having the option to consume small quantities of fish.

These guidelines are based on the world's oldest living populations that are still in existence today and this emphasises the importance of dietary practices on health and longevity. In particular, this shows the beneficial effects of plant based foods and a PBD on health. Although a plant based Mediterranean, Japanese and Paleolithic diet may benefit several chronic conditions such as CVD, diabetes and obesity, there is strong evidence emerging for the use of a whole foods plant based diet (WFPBD) for the treatment of NCDs and for improving general health (Greger 2016, p265).

2.8 Definition of a Plant Based Diet

According to Greger (2016, p10), a plant based diet (PBD) can be defined as an eating pattern that encourages the consumption of unrefined plant foods and discourages meats, dairy products, eggs and processed foods. Unrefined plant foods refer to vegetables, fruits, legumes, whole grains, nuts and seeds (Davis & Melina 2014, p278).

The term 'plant based' is often interchanged with a vegetarian way of eating which encompasses many different variations to the diet. While some choose to exclude all animal products completely (vegan), others may include small amounts of dairy products (lacto-vegetarian) and others may include eggs and dairy (lacto-ovo vegetarian). A pescatarian is one who eats fish, dairy and eggs while a semi-vegetarian may occasionally include poultry in their diet. Being a vegetarian does not always equate to being "healthy" or following a "healthy" lifestyle. Some processed foods, beverages, meat imitations and breakfast cereals can often contribute substantially to the nutrient intake of vegetarians. These foods are often high in saturated fats, sugars, salt and other harmful additives and offer minimal nutritional benefits to the consumer (Melina, Craig & Levin 2016). The concern with the term "vegetarian" or "vegan" is that they are only defined by what is not consumed in the diet and for this reason, the term PBD, or WFPBD is the preferred term (Greger 2016, p265). Harland and Garton (2016) state that a more specific definition for a PBD is required due to the fact that it is a relatively new concept.

As this concept is new, literature refers most commonly to a vegetarian way of eating which encompasses many aspects of the diet such as lacto-ovo vegetarians, pescaterians and semi-vegetarians. Wherever possible, from here on the specific vegetarian dietary pattern is mentioned.

2.8.1 The history of vegetarian nutrition

According to Letizmann (2014) there appears to be three phases to vegetarian nutrition. Phase one occurred between the 1960's and 1970's where a population following a vegetarian diet was thought to be at a higher risk of developing a nutrient deficiency compared to those following a meat-based diet. This theory was based on studies that were conducted in poorer communities where the risk of malnutrition was high and so was not an accurate representation of a vegetarian diet.

Phase two, which occurred between the 1980's and 1990's showed an increase in the number of scientific studies documenting the benefits of vegetarian and PBDs. The reduction in NCDs and increased longevity were linked to the greater variety of plant foods consumed along with the absence of meat in the diet. Although there was an increasing amount of scientific evidence available, the scientific community still believed that the vegetarian pattern put the individual at risk for developing nutritional deficiencies (Leitzmann 2014).

Phase three represents present day beliefs and practices of individuals and health professionals. There has been an increase in numbers of vegetarians worldwide and this can be attributed to ethical, environmental, social and health concerns (Leitzmann 2014). Evidence regarding the benefits of plant based eating has been accumulating with regard to reducing disease risk and enhancing weight management and as these are major health concerns today, the interest in PBD research is growing in the medical community (Harland & Garton 2016).

2.8.2 Plant based diets in practice

The 2016 position statement of the American Academy of Nutrition and Dietetics (ADA) states that "Vegetarians and Vegans are at reduced risk of certain health conditions, including ischemic heart disease, type 2 diabetes, hypertension, certain types of cancer, and obesity." This statement is only true if the diet is based on a low intake of saturated fat and a high intake of vegetables,

fruits, whole grains, legumes, soy products, nuts and seeds (Melina, Craig & Levin 2016). In order to ensure that plant based diets are appropriately planned, a variety of guides exist. The Vegan Plate is one such guide which acts as a versatile tool in order to meet nutritional requirements. This plate was adapted from the Academy of Nutrition and Dietetics and the Dieticians of Canada's original vegetarian eating guides. It comprises five food groups including fruits, vegetables, whole grains, legumes, and nuts and seeds. The foods found at the centre of the plate are those foods within each group that provide 100-150 mg of calcium per serving. The plate is used in conjunction with a daily plan for healthy eating which acts as more descriptive tool for creating meal ideas for individuals and families (Davis & Melina 2014, pp433-435). Figure 2.1 shows the illustrated vegan plate and Table 2.3 shows the daily plan for healthy living to be used in conjunction with the vegan plate guide.

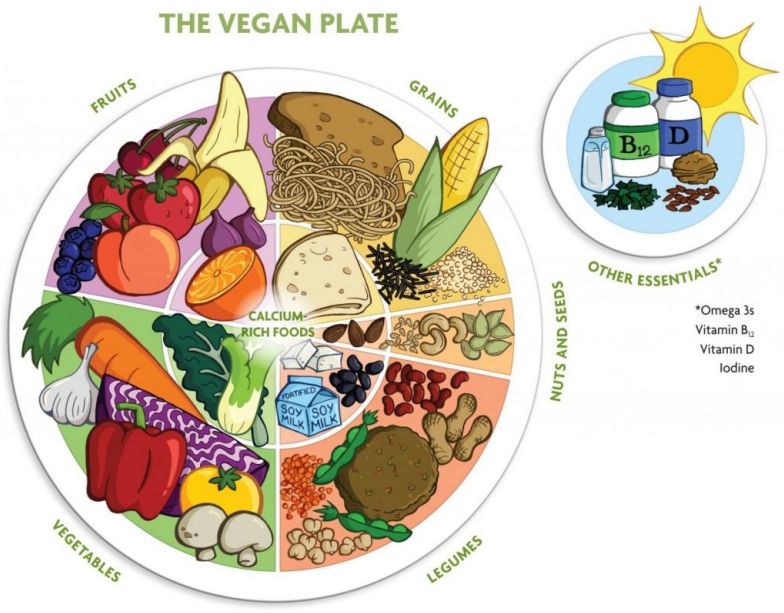

Figure 2.1 Illustration of The Vegan Plate Guide for healthy eating (Davis & Melina 2014, p434)

Table 2.3 The Vegan Plate. Daily Plan for Healthy Eating (Davis & Melina 2014, p435)

Food Group (Servings per day)	**Foods in this group (Serving size)**	**Calcium-rich foods: choose 6-8 servings per day (serving size)**	**Notes**
Vegetables (5 or more servings)	½ cup (c) (125ml) raw or cooked vegetables 1 c (250ml) raw leafy vegetables ½ c (125ml) vegetable juice	1 c (250ml) cooked bok choy, collard greens, napa cabbage, kale, mustard greens, or okra 2 c (500ml) raw bok choy, collard greens, kale or napa cabbage ½ c (125ml) calcium-fortified tomato or vegetable juice	Choose from the full rainbow of colourful vegetables: blue, green, orange, purple, red, yellow, and white. Include at least 2 daily servings of the calcium-rich greens.
Fruits (4 or more servings)	1 medium fruit ½ c (125ml) fruit or fruit juice ¼ c (60ml) dried fruit	½ c (125ml) calcium-fortified fruit juice ½ c (125ml) dried figs 2 oranges	Fruits are excellent sources of potassium. Select from the full spectrum of colourful fruits; feature them for desserts or treats.
Legumes (3 or more servings)	½ c (125ml) cooked beans, peas, lentils, tofu, or tempeh 1 c (250ml) raw peas or sprouted lentils or peas ¼ c (60ml) peanuts 2 T (30ml) peanut butter 1 oz (30g) vegetarian meat substitute	1 c (250ml) black or white beans ½ c (125ml) fortified soy milk or soy yoghurt ½ c (125ml) calcium-set tofu (calcium should be included on the ingredient list), cooked soybeans, or soy nuts	Legumes provide generous amounts of iron, magnesium, potassium, zinc, fibre, and protein, with an average of 7 to 9 grams of protein per serving. Include a selection from this group at most meals.
Grains (3 or more servings)	½ c (125ml) cooked cereal, rice, pasta, quinoa or other grain or grain product 1 oz (30g) bread ½ c (125ml) raw corn, or sprouted quinoa, buckwheat, or other grain 1 oz (30g) ready-to-eat cereal	1 Ounce (oz) (30g) calcium fortified cereal 1 calcium-fortified tortilla	Select whole grains as often as possible. Adjust the number of grain servings to suit energy needs. Some fortified cereals and tortillas are particularly high in calcium (check labels).
Nuts and seeds (1 or more servings)	¼ c (60ml) nuts and seeds 2 T (30ml) nut or seed butter	¼ c (60ml) almonds 2 T (30ml) almond butter or sesame tahini	Seeds and nuts contribute copper, selenium, other minerals, vitamin E, and fat; choose some that are rich in omega-3 fatty acids.

A similar guide with recommended intakes from food groups was designed by Hever (2016) for physicians to use when prescribing PBDs to patients. Slight differences between this guide and The Vegan Plate exist, predominantly because of differences in the serving measures of foods as well as the recommended servings per day. Vegetables in the physicians guide are also broken down into two groups with an emphasis placed on leafy green vegetables in particular. Whilst The Vegan Plate allows for the use of nut butters and vegan meat analogues, the Physicians Guide does not. The Vegan Plate also offers a lot more detail and description about the suggested food groups and the serving sizes. This reflects the different goals that the two guides may have. Whilst the Physicians Guide may be used more for the treatment and prevention of diseases, The Vegan Plate may serve as more of a guide to assist in creating balanced meals and ensuring adequate nutritional intake. Table 2.4 outlines the Physician Guide with the suggested food groups and serving sizes.

Table 2.4 Food group and recommended servings per day. A Physicians Guide (Hever 2016)

Food Group	Recommended Servings per day
Vegetables, all types, including starchy	Freely, with a variety of colours represented.
Fruits, all types	2-4 servings (1 serving = 1 medium piece or ½ cup.
Whole grains (example: quinoa, brown rice, oats)	6-11 servings (1 serving = ½ cup cooked or 1 slice whole grain bread).
Legumes (beans, peas, lentils, soy foods)	2-3 servings (1 serving = ½ cup cooked).
Leafy green vegetables (example: kale, lettuce, broccoli)	At least 2-3 servings (1 serving = 1 cup raw or ½ cup cooked).
Nuts (example: walnuts, almonds, pistachios)	1-2 ounces (1 ounce = 28g).
Seeds (example: chia, hemp, and flax seeds)	1-3 Tablespoons.
Fortified plant milks (example: soy, almond, cashew)	Optional, 2-3 cups.
Fresh herbs and spices	Optional, freely.

According to Craig (2009), the quality of foods consumed is the most important aspect of a WFPBD. Although vegan diets based on whole foods provide many health benefits, concern for micronutrient deficiencies such as vitamins B12 and D, calcium, and long chain omega-3 fatty acids exist. Recommendations for the prevention of these deficiencies include the consumption of supplemental B12 and D (if in colder climates), an increased intake of green, leafy vegetables, and daily intakes of ground flaxseeds, walnuts or chia seeds to supplement intake of omega 3. Typically, nutritionally deficiencies can be avoided if nutritionally adequate food choices are made (Craig 2009).

2.8.3 Nutritional adequacy of a PBD

Five studies were identified that examined the effects of a vegetarian dietary pattern on nutrient intake. Various forms of vegetarian diets were compared to other dietary patterns such as omnivorous patterns. The difficulty in identifying studies specifically regarding a WFPBD is the absence of an official definition to describe this way of eating. A major limitation for studies that address the habitual intake of subjects is that many of the methods use either self-reporting or make the use of food frequency questionnaires (FFQ). This may result in under or over reporting of actual food intake. Small sample populations were frequently used in the studies therefore the results may not be representative of entire populations (Clarys, Deliens, Huybrechts, Deriemaeker, Vanaelst, De Keyzer, Hebbelinck & Mullie 2014).

The most common finding in the comparative studies was that the omnivorous pattern of eating, defined as eating meat or fish and dairy almost every day, was not superior to the vegan diet which is defined as the abstinence of the intake of all animal products (Clarys, Deriemaeker, Huybrechts, Hebbelinck & Mullie 2013). When comparing the nutrient intake between vegan, vegetarian, semi-vegetarian, pesco-vegetarian and omnivorous subjects in Belgium, it was found that the vegan diet had the lowest total energy intake. This group however had the best fat profile including low cholesterol, low saturated fat and higher poly-unsaturated fat intake than the omnivorous diet. Subjects in the vegan and various vegetarian groups also consumed more fruit, vegetables, beans and whole grains than the omnivorous group (Clarys *et al* 2014).

Three types of vegetarians were studied by Draper, Lewis, Malhotra & Wheeler (1993) in London to assess dietary and nutrient intake. These three types included demi-vegetarians;

defined as the avoidance of red meat but the consumption of fish, poultry and dairy products; lacto-ovo vegetarians and vegans. All groups exceeded the dietary reference value (DRV) for calcium and had high intakes of magnesium, iron, copper and zinc. Iodine intake was the main concern with the vegan group who consumed only 50-70% of the DRV. Vitamin D and B12 were also found to be low in the vegan group but sufficient in the demi-vegetarian and lacto-ovo vegetarian groups. All other water and fat soluble vitamin intakes were high across the three groups (Draper *et al* 1993). In assessing the nutritional adequacy of a very low fat vegan diet supplemented with a soy protein powdered beverage in the United States, Dunn-Emke, Weidner, Pettengill, Marlin, Chi & Ornish (2005) found that Vitamin D was the only nutrient where intake was less than adequate intake. All participants in this study met at least 80% of the estimated average requirement for all nutrients.

Table 2.5 summarises the objectives, subjects, methods, results and conclusions of the studies identified to address the nutritional adequacy of a PBD.

Table 2.5 Studies assessing the nutritional adequacy of the vegetarian eating pattern

Researchers	Objectives	Subjects	Methods	Results	Conclusions
Clarys *et al* (2014). Belgium.	To analyse and compare the nutrient intake and dietary quality of vegans, vegetarians, semi-vegetarians, pesco-vegetarians and omnivorous subjects.	n= 1475 Vegan: n=104 Vegetarian: n= 573 Semi-vegetarian: n=498 Pesco-vegetarians: n=145 Omnivores: n=155	Cross-sectional online food consumption survey. A 52-item qualitative food frequency questionnaire (FFQ) was used with the addition of vegan and vegetarian products. The Healthy Eating Index-2010 (HEI-2010) and Mediterranean Diet Score (MDS) were calculated and analysed for nutrient intake.	Vegans had lowest energy, total fat, saturated fat, mono-unsaturated fat, dietary cholesterol, protein, alcohol, and sodium intakes compared to the omnivorous group ($p<0.01$). Differences were less pronounced between the other vegetarian groups. Dietary intake of poly-unsaturated fatty acids, dietary fibre and iron were highest in the vegan group and lowest in the omnivorous group. Highest calcium consumption was in the semi-vegetarians and pesco-vegetarians and lowest in vegans. The vegan diet had the highest HEI-2010 and MDS score while the omnivorous diet had the lowest.	The use of the HEI-2010 and the MDS score to estimate overall dietary quality consistently indicated the vegan diet as the most healthy one.

Table 2.5 Continued

Researchers	Objectives	Subjects	Methods	Results	Conclusions
Clarys *et al* (2013). Belgium.	Compare the nutrient intakes and the diet quality in vegetarian and omnivorous subjects.	Vegetarians: n=69 Omnivores: n=69	Vegetarians recruited through advertising. Omnivores were matched to vegetarians using a data set of omnivore subjects. Subjects completed a 3-day food diary (2 week days and 1 weekend day). The HEI-2010 and MDS were calculated and analysed.	Significant macronutrient differences were found. Protein and total fat intake was lower for vegetarians ($p<0.001$), carbohydrate intake was higher and fibre was almost double for the vegetarian group. The HEI-2010 was significantly higher for vegetarians ($p=0.001$). MDS was also higher for vegetarians.	Macro-and micronutrient intake was closer to the recommended intakes for the vegetarians compared to non-vegetarians.

Table 2.5 Continued

Researchers	Objectives	Subjects	Methods	Results	Conclusions
Farmer, Larson, Fulgoni III, Rainville & Liepa (2011) United States.	To compare dietary quality of vegetarians, non-vegetarians and dieters and to test the hypothesis that vegetarian diets would not compromise nutrient intake when used to manage body weight.	n=13 292 Dieting Non-vegetarian (n= 4216) Non-dieting non-vegetarian (n= 8225) Dieting vegetarian (n= 419) Non-dieting vegetarian (n= 432)	Cross-sectional analysis of dietary recall records and anthropometric data from the National Health and Nutrition Examination Survey of the US population (1999-2004). Data collected using 24 hour recall. Scores calculated for dietary adequacy. Vegetarians were defined as not eating meat, poultry or fish on the day of the survey. Dieters were defined as those that consumed 500kcal less than their estimated energy requirement on the day of the survey.	Fibre, calcium, magnesium, iron, vitamins A,C and E, thiamin, riboflavin and folate intakes were higher for vegetarians than non-vegetarians. Niacin, B-12 and Zinc were lower for vegetarians. Protein, total fat, saturated fat, cholesterol and sodium intakes were lower in vegetarians. Vegetarians consumed twice as much whole grain and legumes compared to non-vegetarians.	The lacto-ovo vegetarian dietary pattern was more nutrient dense than that of non-vegetarians. Vegetarians did not have an increased risk for lower nutrient intakes when compared to non-vegetarians.

Table 2.5 Continued

Researchers	Objectives	Subjects	Methods	Results	Conclusions
Dunn-Emke *et al* (2005). United States.	To evaluate the nutrient adequacy of the very low fat vegan diet in the Prostate Cancer Lifestyle Trial.	n= 39 males	Participants were asked to adopt an ad libitum vegan diet with 10% calories from fat. Recommended daily intake: 3-4 fruit 3-5 vegetable servings 1 or more servings of legumes 1-3 soy product 6-11 whole grains Participants issued and asked to consume a daily 58g serving of fortified soy protein powder and a micronutrient supplement specific to prostate cancer. Dietary assessment measured with unannounced 3 day food diaries collected at 6 months.	Mean dietary intake, excluding vitamin and mineral supplements, met or exceeded the DRIs. Vitamin D was the only nutrient for which intake was less than adequate. All participants met at least 80% of the Estimated Average Requirements for all nutrients.	A well-planned, very low fat vegan diet, supplemented with a fortified soy protein powdered beverage is nutritionally adequate and abundant in many nutrients.

Table 2.5 Continued

Researchers	Objectives	Subjects	Methods	Results	Conclusions
Draper *et al* (1993). London, United Kingdom.	To determine the foods vegetarians eat and to evaluate knowledge and opinions about food and health.	Vegans: n=38 Lacto-ovo vegetarian: n=52 Demi-vegetarian: n=37	3 day weighed dietary intake was completed including a FFQ and interviews on attitudes to diet, health and lifestyle were conducted. Dietary data were analysed using the Ministry of Agriculture, Fisheries, and Food (MAFF) computerised database.	Mean energy, protein and carbohydrate intake was similar across all groups. Vegans had the lowest fat intake with demi-vegetarians consuming the highest. Saturated fat intake was significantly lower in vegans. Calcium, magnesium, iron and zinc intakes were all high and exceeded or were close to DRV. Vegans had lower calcium and iron intakes. Vitamins A, D and E were all high with the lowest vitamin D intake seen in vegans. Vitamin B12 was low in all groups, especially vegans.	Vegans had fat intakes close to recommendations. Mean intakes of all micronutrients for demi- and lacto-ovo vegetarians met the UK DRV. It was recommended that vegans increase B12 intake and perhaps increase riboflavin. More research on iodine was recommended.

2.9 Health effects of a PBD

According to Harland and Garton (2016), in contrast to western eating patterns, a PBD is associated with a low intake of total fat and saturated fatty acids and a good source of unsaturated fatty acids, high fibre, antioxidants, vitamins and minerals. For many years research has supported the use of whole plant foods, namely vegetables, fruits, whole grains and legumes in the treatment and prevention of diet-induced diseases (Davis & Melina 2014, p35). Additional benefits of following a PBD can be seen when avoiding constituents found in animal products that include saturated fats, dietary cholesterol, antibiotics and chemical contaminants which are formed when cooking animal products (Hever 2016). Research on a PBD is growing and although there is a paucity of research surrounding this topic in South Africa, international researchers have made significant findings. A move toward a more PBD may be beneficial to CVD health, and may reduce the incidence of type 2 diabetes, obesity, and the metabolic syndrome (Harland & Garton 2016).

Results from studies that assess dietary intake generally have similar limitations and these need to be considered. These limitations include the use of tools such as the FFQ or diary records that may provide only rough estimates of food intake and may be subject to under or over reporting. Most studies were cross sectional and therefore the period of time that subjects had eaten in a specific way was not taken into account and may have affected the results. Study samples in vegetarian and vegan populations have generally been small and definitions of these groups has varied between studies. Therefore the results cannot always be applied to the greater population. These limitations are all acknowledged in presenting the research obtained regarding the effect that a PBD has on CVD, overweight/obesity and type 2 diabetes.

2.9.1 The role of vegetarian diets on CVDs

Vegetarian diets have proven beneficial for modifiable risk factors of CVD such as abdominal obesity, blood pressure and blood glucose which are becoming major health issues in developing countries including South Africa. The lower risk of heart disease may be attributed to the regular consumption of plant based foods but also includes a low body weight that is regularly seen in vegetarian subjects (Melina *et al* 2016). A study conducted on 139 habitual meat eating and vegetarian men in Melbourne Australia, found that meat eaters had a significantly higher cluster

of CVD risk factors, including BMI, waist to hip ratio and total cholesterol than vegetarian men. No major differences in risk factors between the vegan and lacto-ovo vegetarian group was noted but a decreasing trend in risk was noted from high and moderate meat eaters to lacto-ovo vegetarians and vegans (Li, Sinclair, Mann, Turner, Ball, Kelly, Abedin & Wilson 1999). Similarly, a 1999 meta-analysis of five different studies among vegetarians (no meat or fish, n= 27 808) and non- vegetarians (n=48 364) found that the mortality from heart disease was 24% less in the vegetarian group when compared to the non-vegetarian group. Interesting to note was that reducing meat intake to once per week reduced risk of death by 20% (Key, Fraser, Thorogood, Appleby, Beral, Reeves, Burr, Chang-Claude, Frentzel-Beyme, Kuzma, Mann & McPherson 1999).

Studying dietary patterns, rather than isolated nutrients in disease outcomes is difficult as they cannot be measured directly. Factor analysis has been used to report information from FFQs to identify common underlying factors and patterns of food consumption (Hu, Rimm, Stampfer, Ascherio, Spiegelman & Willett 2000). This was done in two separate studies in the United States on women to address dietary patterns and risk of heart disease. In order to determine fruit and vegetable intake and the association to CVD, female health professionals (n=39 876) were followed over a five year period. Similarly female nurses (n=75 521) were followed over a ten year period to determine the effect of whole grain consumption on CVD risk. In both studies, a prudent pattern and a western dietary pattern were identified as the dominant dietary practices based on the completed FFQs. Both studies concluded that a higher prudent score was associated with a lower risk of heart disease. The higher consumption of whole grains, fruit, legumes, vegetables, poultry and fish compared to red and processed meats and refined grains in these studies appeared to be responsible for reducing risk (Fung, Willett, Stampfer, Mason & Hu 2001; Hu *et al* 2000). This was confirmed in the results from two women's studies conducted in the United States that independently evaluated the effect of whole grains and fruit and vegetable intake on heart disease risk of CVD. In both studies, subjects had no previous history of CVD and information was collected with the use of a FFQ. An increased consumption of whole grains, in particular whole grain breakfast cereals, brown rice, popcorn and bran was associated with reduced risk. Similarly, as fruit and vegetable consumption increased, the relative risk of CVD decreased. However, when adjustments for age and smoking were made, no change in result was

noted in either study (Liu, Manson, Lee, Cole, Hennekens, Willett & Buring 2000; Liu, Stampfer, Hu, Giovannucci, Rimm, Manson, Hennekens & Willett 1999).

2.9.2 The role of vegetarian diets on weight loss and BMI

Vegans have an advantage in maintaining healthy body weight in comparison to non-vegetarians (Davis & Melina 2014, p39). Scientific literature indicates that it may be beneficial to examine whether PBDs are inversely related to obesity. Of greater importance is to determine whether animal products such as lean protein and dairy foods are helpful for controlling weight (Newby, Tucker & Wolk 2005).

Since the 1990's studies have been conducted comparing body weight and weight loss dietary patterns among vegetarians, vegans and omnivores. One of the largest studies conducted to date is the EPIC-Oxford study which assessed the BMI and risk for overweight or obesity between British meat eaters, fish eaters, vegetarians and vegans (Spencer, Appleby, Davey & Key 2003). This study was conducted between 1993 and 1999 with over 37 875 participants. Although the BMI in all groups was within the healthy range, it was found to be lowest in vegans and highest in meat eaters. Nutrient intakes were found to be significantly different between the groups with meat-eaters consuming the most energy, protein, total fat, saturated fat and monounsaturated fats while vegans had the highest intakes of fibre and polyunsaturated fats. From this study it was found that the dietary factors most strongly linked to an increase in BMI were a high protein and low fibre intake (Spencer *et al* 2003). The same results and conclusions were reported from the Oxford Vegetarian Study conducted between 1980 and 1984 in the United Kingdom. This study described the differences in BMI between meat eaters and non-meat eaters to explore how much the difference could be explained through the consumption of animal fat, dietary fibre and alcohol. Meat consumption, dietary fibre intake and animal fat intake were all independently associated with BMI which was lower in non-meat eaters than meat eaters (Appleby, Thorogood, Mann & Key 1998).

Another large study was conducted on 55 459 Swedish women to determine BMI and the risk of being overweight between self-defined omnivores, semi-vegetarian, lacto-vegetarian and vegan women. Dietary intakes were assessed using a FFQ and women were reclassified into groups according to their reported intake. Results showed that omnivorous women were significantly

heavier (66.6 ± 10.9kg) with greater BMIs (24.7 ± 3.9) than any of the three vegetarian groups. Among the three vegetarian groups, vegans had the lowest weight and a significantly lower risk of overweight or obesity (Newby *et al* 2005). Another study conducted on women from Washington State (n=62) compared a vegan diet to a moderate low fat diet in a 14 week intervention trial. Follow up was conducted at one and two years post intervention to assess weight loss. The vegan diet was made up of whole plant based foods and the low fat diet was based on the National Cholesterol Education Program (NCEP) diet in the United States. No energy restrictions were given to either group. Weight loss after one and two years was greater in the vegan group. While both diets were low in fat and calories, the vegan group reported higher intakes of fibre. This group may have been taking in less energy but were still consuming a greater amount of food than the NCEP group. The primary mechanism on controlling weight may therefore be a reduced fat and increased fibre intake (Turner-McGrievy, Barnard & Scialli 2007).

More recently in South Carolina, Turner-McGrievy, Davidson, Wingard, Wilcox and Frongillo (2015) conducted a two month intervention trial with a four month follow-up to determine the effectiveness of a PBD on weight loss. Participants (n=50) were randomly assigned to vegan, vegetarian, pesco-vegetarian, semi-vegetarian or omnivorous groups with no calorie restrictions. The trend for weight loss at both two and six months was significant ($p<0.01$) across all five groups with the most weight loss seen in the vegan group and the least in the omnivorous group. Dietary energy intake was only different between the vegan and omnivorous group at six months with vegans decreasing energy intake. Vegans had a lower fat, saturated fat and cholesterol intake but a greater carbohydrate and fibre intake than the other groups (Turner-McGrievy *et al* 2015).

The BROAD study was conducted in New Zealand to investigate the effectiveness of a WFPBD on patients diagnosed with obesity or being overweight (n=49). Subjects were also diagnosed with at least one of type 2 diabetes, ischaemic heart disease, hypertension or hypercholesterolaemia and assigned to a normal care group or the WFPBD group. Reductions in BMI and weight were statistically significant for the WFPBD group at six (4.4kg/m^2; 12.1kg) and 12 months (4.2kg/m^2; 11.5kg). Within the control group there was no significant differences noted. No calorie restrictions were placed on the intervention group but the reduction in the

energy density of foods (higher fibre and lower fat intake) appears to be a consistent mechanism responsible for weight loss (Wright, Wilson, Smith, Duncan & McHugh 2017).

2.9.3 The role of vegetarian diets on type 2 diabetes

Dietary habits and body weight play an important role in type 2 diabetes, but the best eating pattern to address glycaemia, CVD risk factors and weight control remains controversial (Trapp & Levin 2012). According to the 2014 ADA position statement on diabetes, there is not a "one size fits all" eating pattern for individuals with type 2 diabetes. General guidelines include portion control, whole grain consumption, the use of lean proteins, and a lower fat intake (Evert, Boucher, Cypress, Dunbar, Franz, Mayer-Davis, Neumiller, Nwankwo, Verdi, Urbanski & Yancy 2014). As PBD are lower in saturated fats and energy and higher in unsaturated fats and fibre than the typical Western diet, they have been seen to be beneficial in the treatment and prevention of type 2 diabetes (Harland & Garton 2016).

Reports of meat, processed meat and fat intake on diabetes risk have all reported very similar results, in that these foods may increase relative risk for the development of the disease. In a study conducted on Seventh-Day Adventists (n=8401) in California, meat eaters were at a 29% greater risk of developing diabetes then vegetarians and occasional meat eaters that consumed meat less than once per week. The long-term adherence over a 17 year period to a meat eating and a vegetarian dietary pattern was associated with a 74% increased risk for the development of the disease. However, obesity and weight gain appeared to have had a large role to play in the follow up study as this was a common trend noted among the meat eating group (Vang, Singh, Lee, Haddad & Brinegar 2008).

Three studies from France and the United States that looked at the role of processed and unprocessed meat specifically in women found that these foods were independently associated with an increased risk of diabetes. More specifically, both The Nurses' Health Study (n=69 554) and The Women's Health Study (n=37 309) conducted in the United States found that a higher meat intake was also associated with a Western dietary pattern and therefore a higher fat, cholesterol and low fibre intake. After adjustments were made for physical activity, smoking, family history and nutrient factors across the three studies, it was found that processed meats posed a greater risk for the development of diabetes than unprocessed meats (Lajous, Tondeur,

Fagherazzi, de Lauzon-Guillain, Boutron-Ruaualt & Clavel-Chapelon 2012; Fung, Schulze, Manson, Willett & Hu 2004; Song, Mason, Buring & Liu 2004). Similarly in men from the United States (n=42 504), processed meat was also associated with an increased risk of Type 2 diabetes, as was total and saturated fat intake (Van Dam, Willett, Rimm, Stampfer & Hu 2002).

Randomised controlled clinical trials have shown that vegan diets based on plant based foods are effective in the treatment of type 2 diabetes. Barnard, Cohen, Jenkins, Turner-McGrievy, Gloede, Jaster, Seidl, Green and Talpers (2006) assessed whether a low fat vegan diet (<10% total energy from fat) improved glycaemic control in individuals from Washington DC with type 2 diabetes. Subjects were assigned to a vegan group (n=49) with unrestricted calories or a diet following the ADA guidelines (n=50) for 22 weeks. After 22 weeks it was found that 43% of the vegan group and 26% of the ADA group reduced their medication intake. This study was then extended to a 74 week trial by Barnard, Cohen, Jenkins, Turner-McGrievy, Gloede, Green and Ferdowsian (2009a). By the end of the 74 weeks, medication had been reduced by 71% and 58% of subjects in the vegan and ADA groups respectively. Both groups lost weight but more significant weight loss was seen in the vegan group at 22 and 74 weeks. In this study, dietary adherence was greater in the vegan group at 22 and 74 weeks (67%, 51%) than the ADA group (44%, 48%) which may be related to the limitations on portion sizes of meals according to ADA guidelines. The results from this study state that although both diets had positive outcomes, a low fat vegan diet shows greater improvements than a diet based on the ADA guidelines (Barnard *et al* 2009a; Barnard *et al* 2006).

The type of vegetarian diet and prevalence of type 2 diabetes was assessed in 22 434 men and 38 469 women members of the Seventh-Day Adventist church across America. Groups were divided into vegan, lacto-ovo vegetarian, pesco-vegetarian, semi-vegetarian and non-vegetarian categories based on responses to a self-administered questionnaire. The results of this study showed that the prevalence of type 2 diabetes increased from 2.9% among vegans to 7.6% in non-vegetarians. Vegan and lacto-ovo vegetarian diets were associated with almost one half the reduction of diabetes risk compared with non-vegetarian diets. In fact, it was found that the inclusion of meat, meat products, and fish in the diet, even once a week appeared to limit the protective effect associated with vegan and lacto-ovo vegetarian diets. Subjects across all the

vegetarian groups also had a lower BMI than those in the non-vegetarian group with vegans having the lowest BMI (Tonstad, Butler, Yan & Fraser 2009).

A 24 week trial comparing the effects of calorie restricted vegetarian and conventional diabetic diets with exercise was conducted on 74 subjects with type 2 diabetes from the Czech Republic. This was to determine the diets effect on insulin resistance, visceral fat and oxidative stress marker. All meals in this study were provided to subjects and measure performed after 0, 12 and 24 weeks after a 10-12 hour fast. The vegetarian diet used in this study was predominantly plant based with the only one serving of yoghurt allowed per day. While both groups had a reduction in energy and fat intake, the vegetarian group increased carbohydrate and decreased protein and cholesterol intake with no changes seen in the control group. Diabetes medication was reduced in 43% of participants in the vegetarian group and 5% in the control group. Body weight, waist circumference, subcutaneous fat and visceral fat dropped more in the vegetarian group than the control group. The conclusion of this study stated that vegetarian diets were more effective in improving insulin sensitivity than the conventional diabetic diet. It too states that vegetarian diets may provide a beneficial alternative for nutritional therapy for patients with type 2 diabetes, especially when used in combination with exercise (Kahleova, Matoulek, Malinska, Oliyarnik, Kazdova, Neskudla, Skoch, Hajek, Hill, Kahle & Pelikanova 2010).

According to Davis and Melina (2014), type 2 diabetes has been called the plague of the twenty-first century and has been caused purely by overconsumption and the shifting of cultural paradigms. Although the role of plant based diets in the treatment and prevention of this disease is still in the early stages, the role of plant based foods themselves with the high fibre, low fat content has proven to be beneficial for glycaemic control (Davis & Melina 2014, p64; Trapp & Levin 2012). According to Trapp and Levin (2012), clinicians believe that a PBD is too difficult for their patients to follow and the shift to eating more plant based foods from current eating patterns represents too significant a dietary change.

2.10. Perceived benefits and barriers of a PBD in dietetic practice

For the purpose of this section of literature, the term vegetarian refers to all forms of this dietary pattern.

2.10.1 Perceived benefits

A study addressing the perceptions and practices of self-defined current vegetarian (n=90), former vegetarian (n=35) and non-vegetarian (n=68) Canadian women regarding the consumption of animal products was conducted by Barr and Chapman (2002). The primary reasons for not eating meat by vegetarians included feeling sluggish, the presence of toxins, hormones and antibiotics in meat and difficulty in digestion.

In an American weight loss study conducted by Smith, Burke and Wing (2000), 428 individuals were assessed to determine whether they remained on vegetarian diets longer than a weight loss diet. Subjects were self-defined vegetarians, semi vegetarians and vegans. When asked the reasons for adopting a vegetarian diet, responses such as health, disgust with the appearance of food, animal welfare, personal appearance and weight loss were given. The vegetarian subjects were found to adhere to the diet for a longer duration than those on a weight loss diet (24 months and 4 months respectively).

In a randomised controlled trial, 59 post-menopausal women in the United States of America were assigned to either a low fat diet or a vegan diet to determine the acceptability of the diets. No calorie restrictions were given and dietary restraint was measured using a food acceptability questionnaire. Both groups experienced weight loss and 71% of the vegan group indicated that continuing the diet would be easy. In terms of food preparation, 75% of the vegan group indicated that food was easy to prepare (Barnard *et al* 2004).

Lea and Worsley (2003) studied 603 Australian vegetarians, semi-vegetarians and non-vegetarians to examine the factors that were associated with the beliefs that vegetarian diets provide health benefits. The reported health benefits included the consumption of greater quantities of fruit and vegetables and less saturated fat which was linked to the prevention of diseases, weight control and staying healthy in general. Interestingly, the health benefits were more important to the semi-vegetarian and vegetarian group than they were to the non-vegetarian group.

A Canadian study that addressed fruit and vegetable intake found personal benefits such as feeling good, feeling better and having more energy were more important than health benefits (Maclellan, Gottschall-Pass & Larsen 2004).

2.10.2 Perceived barriers

According to Lee, McKay and Ardern (2015), low patient interest and difficulty in adopting a vegetarian diet are often reasons cited for the lack of promotion of this lifestyle. Reasons given for resuming an omnivorous diet by Canadian women included health related reasons (weakness, fatigue, anaemia), missing meat, changes in living situation, that it was time consuming to eat as a vegetarian and nutrient concerns such as not getting enough protein from this diet (Barr & Chapman 2002).

Subjects in the Smith *et al* (2000) weight loss study that discontinued the vegetarian diet and resumed eating meat (64%) listed reasons such as they missed eating meat, the diet was inconvenient and there were not enough nutrients. Those in the weight loss diet group listed reasons such as lost interest or became bored and missing certain foods as to why the diet was discontinued.

According to Lee *et al* (2015), when Canadian clinical staff were questioned regarding their perceptions of PBD as a treatment option for type 2 diabetes, the response was not positive. The three most common reasons for not using PBDs were, the eating pattern is not realistic and too difficult to adhere to; there is low perceived acceptance from patients; and there is a lack of clinical guidelines and educational support. However two thirds of patients questioned in the same study stated that they would be willing to follow this diet for a short time if educational support was provided. Other reasons for not adopting a PBD included family influence, preference of eating meat and lack of planning skills (Lee *et al* 2015).

A lack of knowledge and the convenience of vegetarianism were indicated as barriers by the non-vegetarian group in 603 Australian vegetarians, semi-vegetarians and non-vegetarians. This group also felt that they did not need to improve the quality of their current diets but were aware of the benefits associated with a vegetarian eating pattern. Providing information about how to prepare convenient and healthy plant based meals may encourage non-vegetarians to achieve a more PBD (Lea & Worsley 2003).

Fruit and vegetables form a large component of a PBD and a UK study addressed the factors associated with the intake of these foods. These factors included time, familiarity and habit, social interactions, monetary, personal ideology, media and advertising, and health. These factors

indicate the complexity surrounding food choices as some factors such as familiarity and habit can be both a benefit and a barrier to increasing fruit and vegetable intake (Pollard, Kirk & Cade 2002). Barriers in a Canadian study that addressed fruit and vegetable intake included lack of knowledge, social influence and availability of produce (Maclellan *et al* 2004).

A study conducted on 570 American dieticians to determine their opinion regarding climate change found that dieticians were divided when asked if animal products were essential for a healthy diet. Almost 50% of dieticians surveyed strongly agreed or agreed that animal products were essential while 8% said they were unsure. Providing knowledge, skills and experiences to increase comfort in prescribing PBDs among dieticians could make a difference to the general public (Hawkins, Balsam & Goldman 2015). Vegetarian diets are based on qualitative rather than quantitative guidelines and are therefore relatively easy to understand. They do however require patients to learn new tastes and new food preparation techniques which require some initial effort. Adherence to a PBD requires support and addressing the barriers to change or the factors that influence dietary behaviour are important for future policy designs (Barnard, Katcher, Jenkins, Cohen & Turner-McGrievy 2009b).

2.10.3 Barriers to dietary and behaviour change

Dietary change requires giving up long established eating habits and in order for dietary changes to be effective, self-management training for the patient must be provided in a manner that is relative to their individual circumstances (Kapur, Kapur, Ramachandran, Mohan, Aravind, Badgandi & Srishyla 2008).

Two separate studies conducted in India and the United States on 350 and 446 type 2 diabetic patients respectively, assessed the barriers to changing dietary behaviour or following dietary recommendations. Barriers to change were divided into patient related or health care professional/delivery system barriers. Interestingly, in both studies, subjects reported that strict meal times with caloric restrictions made dietary adherence difficult. This was in contrast to what a PBD promotes as most studies conducted allowed for unrestricted caloric intake focusing rather on the quality of foods consumed. Patient related barriers to change included busy lifestyles, health consciousness and knowledge, lack of family support, cost of diet, difficulty in social settings and dislike of food. Other barriers with regard to the health system included lack

of communication and encouragement from professionals, cultural differences and poor quality of advice (Kapur *et al* 2008; Vijan, Stuart, Fitzgerald, Ronis, Hayward, Slater & Hofer 2004).

Food choices can have an adverse effect on health status and decisions are based on many different complex factors. Pollard, Kirk and Cade (2002) addressed the factors affecting food choice in relation to fruit and vegetable intake which can be applied to health foods in general which make up a PBD. Table 2.6 lists the influencing factors and an in depth look at each of these.

Table 2.6 Factors influencing food choice (Adapted from Pollard *et al* 2002; Worsley 2002)

Factor	**Description**
Familiarity and Habit	• Formed at a young age • Based on culture and tradition
Social Interactions	• Friends and family • Eating out • Societal influence
Monetary	• Fresh vs processed foods • Health foods cost more
Time	• Time to shop • Time to prepare food • Fresh foods may require more frequent shop visits • Long work hours reduce cooking time
Personal Ideology	• Organic vs not organic • Genetically modified • Food packaging • Health • Supporting local
Media and Advertising	• Contradictory messages • Promotions
Health	• Associated benefits of food

2.11 The influence of nutrition knowledge on dietary behaviour

The status and role of nutrition knowledge is uncertain where scientific knowledge is essential in driving decisions. It can be said that if the general population are informed and educated about what is good and healthy, then ideally behaviour will reflect that knowledge (Worsley 2002).

Nutrition knowledge is knowledge of nutrients and nutrition that is factual and useful for taking informed action. This information is not always easy for the consumer to understand so instead knowledge for consumers includes guidelines to lose weight, prevent cancer, food safety, 'additives' and their effects and much more. Individuals generally have knowledge in what they are interested in and so nutrition education is an important factor when behavioural change is required (Sharma, Gernand & Day 2008; Worsley 2002).

Food behaviours can be general such as shopping, or specific such as choosing foods according to health influences whereas knowledge is placed among a set of perceptions that a person has about certain foods. When knowledge is set against food behaviour, knowledge may in fact be dismissed due to personal preference (Worsley 2002). This was evident in a study conducted by Sharma *et al* (2008) who found that although knowledge of dietary guidelines was high among the study sample of Mexican Americans, fruit and vegetable intake remained low. In fact, this problem is frequently reported when patients are placed on treatments plans for obesity and diabetes. Despite education from health professionals empowering the patients with knowledge, behaviours often do not change. It is possible that other psychosocial and environmental factors such as skill, attitude, beliefs, self-efficacy, social support and availability of certain foods may have a negative impact (Sharma *et al* 2008).

A knowledge and attitude study on vegetarian diets was conducted on 183 American dieticians across three different states by Duncan and Bergman (1999). The results from this study found that knowledge and attitude scores were higher among those dieticians that had previously or who were currently following a vegetarian eating pattern. The overall attitude score was found to be positively correlated with the knowledge score which indicates the importance of dieticians staying up to date with scientific dietary trends.

However despite knowledge, other factors may impact dietetic practice. According to Byham-Gray, Gilbride, Dixon and Stage (2005), adopting an evidence based approach in the dietetic profession is not optional, but a requirement for achieving a high standard of patient care. Their study conducted on 258 American dieticians cited lack of resources, poor organisational culture and unsupportive healthcare team members as barriers for applying research findings to practice. In this study, registered dieticians employed as faculty members, those who read research frequently and those who were members of at least two professional associations had greater

perception, attitude and knowledge scores toward the dietetic profession. This may in turn reflect patient care and the ability of the professional to influence dietary behaviour change (Byham-Gray *et al* 2005).

2.12 Can the attitude and opinion of healthcare provider influence change?

In a study conducted on 400 Australian dieticians to determine their attitudes to obesity management, 80% of the subjects felt that their time would be best spent in developing strategies to prevent overweight and obesity. When asked whether they find counselling clients about weight loss rewarding, 40% indicated strongly disagree to the statement. Frustrations reported included patient compliance, motivation and expectation which in turn reflected on the attitude of the dieticians in feeling ineffective in practice. While dieticians and healthcare providers are experts in their relevant fields, patient compliance depicts success which can impact the provider's attitude to practice (Campbell & Crawford 2000).

In determining what influences the provision of effective nutrition management, the interface between fifteen dieticians and fourteen general practitioners was studied in Australia. Barriers to providing nutrition counselling according to the general practitioners included time and knowledge, whereas the dieticians felt that time and lack of patient interest was a barrier. Both groups felt that a patient not motivated to change their behaviour should be counselled on the risks associated with resistance to change. The survey suggested that patient-nutrition management issues are complex and research needs to address attitudinal issues for successful management (Nicholas, Pond & Roberts 2003).

In the theory of explaining behaviour change or attitude of health professionals, it is important to consider that individuals working in healthcare do not always have complete control over their actions. Patient preferences and organisational barriers can influence the healthcare professionals' perception of care and treatment method. It is perhaps the attitude of the patient that therefore influences the level of treatment offered by the professional (Ecceles, Grimshaw, Walker, Johnston & Pitts 2005).

The dietician however still has a role to play in relaying scientific based evidence to patients and is required to stay up to date with current research (Byham-Gray *et al* 2005).

2.13 The role of the dietician in practice

Dieticians play a key role in educating patients about numerous health topics. The dietician has to take the patients current life circumstance into account and therefore having an understanding of the patients' dietary behaviour is essential prior to promoting dietary change. There are many challenges to changing behaviour which are made more difficult by the availability of convenience and processed foods (Tapsell 2017). In order for dieticians to provide effective counselling on the adoption and implementation of a PBD, sufficient knowledge, confidence, and access to educational materials is required (Melina *et al* 2016).

Hever (2016) provides a step by step guide for initiating and maintaining a nutrition dialogue with a patient. It includes beginning the consult with questions about dietary behaviour such as how many vegetables and fruits are consumed daily and how many times per week meat and processed meat are included in the diet. This should then be followed up with the suggestion of a PBD as a treatment plan which should include information of the benefits associated with this diet. A gradual start should be encouraged by including meat free days, incorporating more green leafy vegetables daily, and the choice of whole grains over refined grains. Education about the risk of an inadequate dietary intake, excessive meat consumption, and the benefits of whole grains should be discussed and educational material in the form of pamphlets or website suggestions should be given. Maintaining a good relationship and follow ups with the patients are also important to encourage behaviour change (Hever 2016).

2.14 Sustainable diets

There has been a call for health professionals to promote the use of sustainable diets in practice. This is a new complex concept with many gaps in understanding as to what a sustainable diet is comprised of (Macdiarmid, Kyle, Horgen, Low, Fyfe, Johnstone & McNeill 2012). What is known is that this diet should have a low environmental impact and should contribute to food and nutrition security. Currently, a large percentage of foods are being consumed that are posing a threat to the health of the population and the environment due to urbanisation and the increased consumption of meat, dairy, oil, salt and processed foods (Johnstone, Fanzo & Cogill 2014). Climate change will have an effect on food security in the future and one of the main

contributors to this is the livestock industry. In comparison to plant based agriculture, meat production has a higher environmental impact (Joyce, Dixon, Comfort & Hallett 2012).

More research is required on the promotion of PBDs for environmental sustainability as consumers may respond better to a diet promoting health rather than the environment. These sustainable diets however, present an opportunity to eliminate poverty and food insecurity by taking grains fed to livestock and placing it into human hands (Foley 2011). A shift in thinking of diets in terms of nutritional adequacy alone needs to change and should rather incorporate aspects of access and affordability of foods, environmental sustainability and cultural acceptability (Johnstone *et al* 2012). This concept of changing to a PBD in order to improve food security should be at the forefront of future policies in South Africa considering the rise in prevalence of over and undernutrition within the same households. According to Hawkins *et al* (2015), providing Dieticians with educational opportunities and experiences that can increase knowledge, skills, and abilities with regard to diet-related climate change and the resultant benefits associated with these changes, could prove to be beneficial.

2.15 Summary

South Africa is currently experiencing a high percentage of the population suffering from NCDs such as type 2 diabetes, hypertension and heart disease. These diseases are commonly noted in obese individuals where poor dietary habits and reduced physical activity play a role in their health status. The nutrition transition has resulted in an increased consumption of convenience foods that are high in fat, sugar and low in fruits, vegetables and fibre. With a high percentage of the South African population moving into urban areas, dietary habits have shifted from traditional diets to the adoption of a western eating pattern which has resulted in this increase of NCDs. Education regarding the role of food in the prevention of disease is therefore essential as bad dietary habits lead to a compromised health status.

While the vegetarian eating pattern has been noted in literature for many years, more specific definitions are being used to define this way of eating that encompasses ‘whole foods’. Research has shown that a PBD based on whole grains, legumes, fruits, vegetables, nuts and seeds are beneficial in controlling weight and reducing the risk of type 2 diabetes and CVD. Not only is a PBD shown to be useful in the prevention of disease, but it also encourages an increased intake

in vitamins, minerals and fibre when compared to the highly processed western diet. This topic has yet to be studied in South Africa and the many sub definitions that fall under the term ‘vegetarian’ make for a more complex area of study. International researchers and health organisations such as the ADA are however motivating and expanding awareness regarding PBD to health professionals and the lay public.

With dieticians playing an important role in nutrition education to the public, it is essential that they are kept up to date with emerging research and topics of interest. This study addressed the attitude and knowledge as well as the opinion of KZN dieticians toward the perceived benefits and barriers of a WFPBVD. This was done to determine whether a WFPBVD could be used in the management of NCDs. It also looked at the demographics of the dieticians and the knowledge of terms used to define a diet based on whole foods.

The next chapter will outline the methodology that was used in order to achieve the study objectives.

CHAPTER 3: METHODOLOGY

This chapter will address the methodology used to conduct the study. The following sections will be presented: the type of study conducted and the literature in support of the study design; the survey questionnaire design and population and sample selection; the steps taken to ensure validity and reliability of the survey; the pilot study; the statistical analysis of the data; and the ethical considerations of the study.

3.1 Study Design

A quantitative, cross sectional study was conducted on dieticians in KZN to determine their opinions of a WFPBVD. This was done using an online survey.

3.2 Study setting

The study took place in the KZN province of South Africa. KwaZulu-Natal follows Gauteng with the second highest population rates as indicated by the last population census (Statistics SA 2011) and is made up of nine districts. According to the census, when categorised by racial group, the province was predominantly black African (86.8%), followed by Indian or Asian (7.37%), White (4.18%) and Coloured (1.38%). Females made up 52.48% of the population with males contributing 47.52% (Statistics SA 2011).

3.3 Type of Study

3.3.1 Cross sectional study

According to Levin (2006), a cross-sectional design is used when the purpose of the study is descriptive and most often the study is carried out in the form of a survey. The purpose of this study was to determine the possible use of a WFPBVD in the management of NCDs. As this study aimed to elicit information regarding a specific topic at one point in time it used a cross-sectional design with a survey questionnaire as its primary research tool. Cross-sectional studies are useful for generating hypotheses for future research (Levin 2006).

3.3.2 The use of a questionnaire

Survey questionnaires have been used to assess knowledge, views and attitudes of health professionals (Braithwaite, Emery, de Lusignan & Sutton 2003). The two main types of

questionnaires that are generally used are the self-completion questionnaire and the structured interview (Struwig & Stead 2001, p89). According to Bryman and Bell (2015, p170) these two methods are similar, with the obvious difference that the self-completion questionnaire does not have an interviewer present and respondents must answer the questions themselves without assistance. As a result, self-completion questionnaires when compared to the structured interview questionnaire tend to have the following characteristics (Bryman & Bell 2015, p170):

- Consist of fewer questions;
- Are generally shorter in length to prevent respondent boredom or fatigue;
- Have an easy to follow design to ensure the respondent answers the survey in its entirety.

These characteristics are similar to those presented by Struwig and Stead (2001, pp89-90), who state that in order for the questionnaire to maintain the attention of the respondents it should consider the following guidelines:

- Have clear guidelines on how to answer questions;
- Sections of the questionnaire are divided into logical subjects;
- Simple questions are placed at the start;
- Questions should proceed from general to specific;
- Personal or sensitive questions should be kept until the end of the questionnaire;
- Use vocabulary that the respondent understands;
- Keep the questionnaire short.

According to Fowler and Cosenza (2008, p136), the answers to questions that are asked in surveys are measures. How the questions are asked represent the most important considerations of the survey instrument that is to be used (Bryman & Bell 2015, p183). When designing the questions it is important to consider the following guidelines:

- Always keep research questions in mind. Valuable data cannot be collected if questions are not designed around the research questions (Fowler & Cosenza 2008, p139).

- Ensure that questions are consistently understood by each respondent. This involves using the right vocabulary, avoiding ambiguous terms in questions and keeping questions short (Bryman & Bell 2015, pp189-190).

- Avoid the use of leading questions that may cause the respondent to feel like they are being pushed in a certain direction (Bryman & Bell 2015, p192).

- Eliminate the use of technical terms. Language used should be simple and plain to ensure that respondents understand the words used in the question. This prevents guessing or refusal of answering the question and thus increases reliability of the measurement (Bryman & Bell 2015, p193; Fowler & Cosenza 2008, p139).

This study made use of scaled-response questions using a Likert scale. According to Struwig and Stead (2001, p94), Likert scales are a common rating format used in surveys that measure attitudes and perceptions. It is important to ensure that there are clear instructions on how to complete the questionnaire when this type of scale is used. A Likert scale can be used to gather quantitative information and is optimal in gathering information measuring attitudes, opinion and descriptions of subjects' environment (Gliem & Gliem 2003). The decision to use a Likert scale was based on the principle that this was a quantitative study and each item to be addressed in the questionnaire had no right or wrong answer. According to Allen and Seaman (2007), the most important aspect of using a Likert scale is to include at least five response categories.

When designing a survey there are many different data collection methods to choose from, mainly face-face and telephonic interviews, mail questionnaires, internet surveys, and a variety of combinations of the above methods (De Leeuw *et al* 2008, p114). All of the methods have advantages and disadvantages however, it is important to standardise the data collection process and thereby standardise the data collected (Strewig & Stead 2001, p86). The advantages and disadvantages of the data collection methods are presented in Table 3.1.

Table 3.1 Advantages and disadvantages of different survey types (Bryman & Bell 2015, pp149-150, pp 170-171; De Leeuw *et al* 2008, pp133-135; Braithwaite, Emery, de Lusignan, Sutton 2003; Struwig & Stead 2001, pp86-88)

Type	Description	Advantages	Disadvantages
Face-to-face Interviews	An interviewer administers a structured questionnaire to a respondent. This is usually done within a limited period of time and in the presence of the respondent.	• Interviews can be unstructured and long questionnaires used. • Interviews are adaptable to the situation. • Further explanations can be provided by both interviewer and interviewee.	• This may be expensive as interviewers require training. • Sampling respondents may be difficult. • Interviewer characteristics may inhibit responses. • Generally takes a long time to complete the project.
Telephone Interviews	Interviews are administered via telephone using a structured questionnaire and within a limited period of time. Interviewers generally work from a central location under supervision.	• They are relatively easy to administer as questions are short and respondents answer briefly. • Quality of information may be higher as there is control and supervision. • Cheaper than personal interviews.	• Respondents are reluctant to provide confidential information over the phone. • Length of interview needs to be quick. • Interviewers cannot engage in observation.
Internet Surveys	This is a form of self-administered questionnaire in which the questionnaire is placed on a website. A web browser is used and responses are transferred through the internet to the server.	• Complex questionnaires and visual stimuli can be used. • Surveys are less intrusive and more private. • Large numbers of surveys can be completed and collected at a relatively low cost and in a short amount of time. • Ease of implementation. • Data can be transferred automatically into a database.	• Internet access varies between individuals. • Questionnaires must be short. • Formatting may need to be changed to simplify data entry. • Interviewers cannot engage in observation. • Low response rate.

Table 3.1 Continued

Type	Description	Advantages	Disadvantages
Mail Surveys	A structured questionnaire and introductory letter is sent to the respondent, generally via post. Responses are completed in the respondents own time and the questionnaire is then sent back.	• Longer questionnaires can be used. • Personal information can be gathered. • Inexpensive form of data collection. • Convenient for respondents.	• Low response rate. • Questionnaires may be completed by someone other than the intended respondent. • Respondent may not be interested in the topic. • Respondents may not understand some of the questionnaire or how to complete it. • Long period of time between mailing and reporting data.

Based on the analysis of the advantages and disadvantages covered in Table 3.1, this study made use of an online questionnaire. This decision was based on the fact that dieticians generally have busy schedules and an online survey could be completed in a reasonable amount of time. Posting a survey may have resulted in a high non-response rate as surveys may have been lost in the post. Contacting the dieticians via telephone would have needed to be done during business hours and this was unrealistic due to busy schedules.

The respondent features for the use of an online survey presented by Eysenbach and Wyatt (2002), state that respondents should ideally be:

- Avid internet users,
- From a wide geographical area,
- Familiar with completing surveys.

As this study targeted dieticians from the KZN province, using a survey to reach the wide geographical area was ideal. Dieticians also rely on email correspondence to be informed about meetings, changes in the workplace, continuing professional development (CPD) activities and communication with colleagues which provided further affirmation for the use of an online survey. The benefits of living in an advanced technological age is that most people can access email from their phones and this applies to dieticians too. For those who practiced in rural areas and who may have suffered with poor connection to the internet, accessing the survey on their phones using mobile data was possible. An additional benefit to an online survey for dieticians is that there is no paperwork and once complete it does not need to be sent off. With busy schedules it is less likely that the survey would be completed if it required the dietician to send the survey back via post office. For all these reasons the online survey tool was the most convenient form of conducting research in this study population.

3.4 Study population and sample selection

3.4.1 Study population

Registered dieticians (RDs) working in KZN were used as the population group in this study. According to the Health Professions Council of South Africa (HPCSA), 457 KZN RDs were registered in the year 2017 (Daffue 2017). Unfortunately, the protection of personal information

act in South Africa does not allow the sharing of personal information. As a result it was not possible to access the details of all 457 dieticians.

The Association for Dieticians in South Africa (ADSA) is the professional organisation for RDs in South Africa. There are ten branches that allow dieticians to connect within their respective province of practice. The vision and mission of ADSA is to represent and develop the dietetic profession as well as to promote the continued growth of dieticians in South Africa (ADSA 2017). According to the 2017 statistics, 162 dieticians in KZN were registered with the association which is 35% of the total KZN RD population registered with the HPCSA. As access to personal information from the HPCSA was not possible, the 162 RDs registered on the ADSA database were used as the population group for this study.

While this number is not representative of the entire KZN RD population, the benefits of using ADSA included the permission to put the survey in the weekly newsletter without requiring personal details of RDs.

It was anticipated that the RDs registered with ADSA would be up to date with current knowledge surrounding the dietetics profession and would therefore provide an ideal database to research. Using the weekly ADSA newsletter allowed a larger distribution network for the survey, easier recruitment, lower costs and the respondents were able to complete the survey at their leisure. A statistician was consulted in order to determine the number of subjects required for the study sample to be representative of the ADSA population. The sample size was calculated using Cochran's formula with alpha set at .05 and a margin of error of .05 and a sample of 114 was calculated.

3.4.2 Sample selection

The survey was sent out via a weekly newsletter twice over a period of one month to all KZN dieticians registered with ADSA.

3.5 Questionnaire development

To date there has been no study that has looked specifically at dieticians' opinions of a WFPBVD and due to this shortfall the questionnaire was adapted from other studies that addressed the dieticians' opinion toward other health related topics. Likert scale responses and

one open ended question was asked in the questionnaire. The open ended question was used to determine the sources used by dieticians to stay up to date with scientific information in the knowledge and attitude section of the questionnaire. A copy of the questionnaire can be found in Appendix A, page 122.

In measuring the perceived benefits and barriers of a WFPBVD, a five point Likert scale was used. As these sections required responses to statements, close-ended questions were used. These were advantageous to the dieticians as the statements were short to avoid confusion, it allowed for a faster response time to reduce survey fatigue and it was easier to complete online.

3.5.1 Section A of the questionnaire

The first part of the questionnaire addressed the demographic characteristics of the study population as well as work environment. South African studies presented in Table 3.2 that have looked at the dieticians demographics as part of their questionnaire were adapted for the first section of the questionnaire. Demographic characteristics were asked in a standard format according to most studies and this study therefore followed a similar pattern. Age, area of practice and most common disease related topics seen in practice were some of the demographics asked. These had the potential to provide some valuable information regarding WFPBVD in current practice.

Presented in Table 3.2 are the studies used for the development of the demographic section of the questionnaire. The studies looked at dieticians in South Africa and all included a demographic section as part of the questionnaire in the study.

Table 3.2 South African studies used to design demographics of the questionnaire

Authors	Title	Purpose	Study Method	Subjects
Paterson (2006)	Professional development of dietitians completing compulsory community service in South Africa with special focus on Kwazulu-Natal.	To determine the attitude of community service dieticians towards community service at entry and exit.	Post/ Fax/ Email questionnaire. Multiple choice questionnaire.	Dieticians competing community service at entry and exit in 2003 (n=20; n=21), 2004 (n=15, n-16) and 2005 (n=13, n=15).
Steyn, Labadarios, Nel & Robertson (2005)	Development and validation of a questionnaire to test knowledge and practices of dieticians regarding dietary supplements.	To develop a questionnaire that would evaluate the knowledge and practices of dieticians in South Africa regarding dietary supplements.	True/ False questionnaire.	South African dieticians (n=367).

3.5.2 Section B of the questionnaire

Section B of the questionnaire looked at the dieticians' knowledge and attitude towards a WFPBD as well as the familiarity of the terms and foods associated with it. Studies that previously looked at the dietician's attitude toward health related topics were used for this section. As mentioned previously, no other studies have looked specifically at PBDs which required questions to be adapted from other studies to suit this objective. Statements used in this section of the questionnaire were therefore adapted from the studies presented in Table 3.3.

Table 3.3 Studies used for measuring dieticians' knowledge and attitude

Authors	Title	Purpose	Study Method	Subjects
Marx, Kiss, McKavanagh & Isenring (2016). Australia.	Attitudes, beliefs and behaviours of Australia dietitians regarding dietary supplements: A cross-sectional survey.	To determine gaps in knowledge and provide information on how dietary supplements were perceived and used by dieticians in practice.	Online survey using a 5 point Likert scale.	Australian dieticians who consult directly with patients and/or clients (n=231).
Basulto Marset, Casas-Agustench, Babio Sánchez & Salas-Salvadó (2012). Spain.	Knowledge, interest, predisposition and evaluation of functional foods in Spanish dietitians-nutritionists and experts in human nutrition and dietetics.	To evaluate Spanish dieticians and nutrition experts to determine their knowledge of, interest in and predisposition to functional foods.	Online survey using a multiple choice questionnaire.	Spanish dieticians and nutritionists (n=2100). Experts in human nutrition and dietetics (n=122).

Table 3.3 Continued

Authors	Title	Purpose	Study Method	Subjects
Hetherwick, Neyman Morris & Silliman (2006) United States.	Perceived knowledge, attitudes, and practices of Californian registered dietitians regarding dietary supplements.	To investigate the perceived knowledge, attitudes and practices of Californian registered dieticians regarding dietary supplements.	Online Survey using a 5 point Likert scale.	Registered dieticians practicing in the state of California (n=1717).
Campbell & Crawford (2000) Australia.	Management of obesity: attitudes and practices of Australian dieticians.	To document attitudes and current practices of dieticians in the management of overweight and obesity, and to determine their training needs.	Postal Survey. Self-completion questionnaire using a 5 point Likert scale.	Dieticians that were members of the Dieticians Association of Australia (n=602)
Duncan & Begrman (1999) United States.	Knowledge and attitudes of registered dieticians concerning vegetarian diets.	To investigate what dieticians know about the safety, adequacy and health benefits of vegetarian diets. As well as to investigate the dieticians' attitude toward vegetarian diets.	Postal survey. Knowledge and attitude testing using a 3 point Likert scale.	Dieticians from Nebraska, Washington and Vermont (n=182)

3.5.3 Section C and D of the questionnaire

Studies have been conducted to measure the benefits and barriers of a variety of health related topics. Of particular importance to these sections of the questionnaire was a study conducted by Lea *et al* (2006a, 2006b) which looked at the benefits and barriers of PBDs among Australian consumers. The questions relating to benefits and barriers used in these studies were also noted in other studies that may have looked specifically at fruit and vegetable consumption in certain populations such as that by Chuan-Ling and Horwath (2001). For the purpose of these sections, questions were drawn from these studies and others presented in Tables 3.4 (benefits) and 3.5 (barriers) respectively.

Table 3.4 Studies used for the benefits of a WFPBVD section of the questionnaire

Authors	Title	Purpose	Study Method	Subjects
Lea, Crawford & Worsley (2006a). Australia.	Consumers' readiness to eat a plant-based diet.	To examine the readiness to change to a plant based diet among a sample of Australians.	Mail survey. Yes/no response scale; 5 point Likert scale and frequency response options.	Australians from Victoria state (n=1000).
Lea, Crawford & Worsley (2006b). Australia.	Public views of the benefits and barriers to the consumption of a plant based diet.	To determine consumers perceived benefits and barriers to the consumption of a plant based diet.	Mail survey using a 5 point Likert scale.	Australians from Victoria state (n=1000).
Hankey, Eley, Leslie, Hunter & Lean (2003). Scotland.	Eating habits, beliefs, attitudes and knowledge among health professionals regarding the links between obesity, nutrition and health.	To document the knowledge, attitudes, beliefs and eating habits of primary health care professionals with respect to obesity, nutrition and weight management.	Postal survey. Self-completion questionnaire.	General practitioners (n=1400), practice nurses (n=613), practicing dieticians (n= 360)
Pollard, Kirk & Cade (2002). United Kingdom.	Factors affecting food choice in relation to fruit and vegetable intake: a review.	To provide an investigation into the food choice decisions of adults in relation to fruit and vegetable intake.	Review	NA

Table 3.4 Continued

Authors	Title	Purpose	Study Method	Subjects
Chuan Ling & Horwath (2001). Singapore.	Perceived benefits and barriers of increased fruit and vegetable consumption: validation of a decisional balance scale.	To fill a gap in research by developing a scale to measure the pros and cons of decision making for eating more fruit and vegetables.	Mail and telephone survey. Questionnaire included a validated fruit and vegetable food frequency questionnaire and general self-completion questionnaire.	Chinese households in Singapore (n=1200)
Cox, Anderson, Lea & Mela (1997). United Kingdom.	UK consumer attitudes, beliefs and barriers to increasing fruit and vegetable consumption.	To identify relevant beliefs and attitudes of the UK population to increasing fruit and vegetable intake.	Postal survey using a 7 point Likert scale.	2020 adults in the UK

Table 3.5 Studies used for the barriers of a WFPBVD section of the questionnaire

Authors	Title	Purpose	Study Method	Subjects
Marx, Kiss, McKavanagh & Isenring (2016). Australia.	Attitudes, beliefs and behaviours of Australian dieticians regarding dietary supplements: A cross-sectional survey.	To determine existing gaps in knowledge and provide information on how dietary supplements are perceived and used by dieticians in practice.	Online survey using a 5 point Likert scale.	Australian dieticians who consult directly with patients and/or clients.
Lea, Crawford & Worsley (2006a). Australia.	Consumers' readiness to eat a plant-based diet.	To examine the readiness to change to a plant- based diet among a sample of Australians.	Mail survey. Yes/no response scale; 5 point Likert scale and frequency response options.	Australians from Victoria state (n=1000).
Lea, Crawford & Worsley (2006b). Australia.	Public views of the benefits and barriers to the consumption of a plant based diet.	To determine consumers perceived benefits and barriers to the consumption of a plant based diet.	Mail survey using a 5 point Likert scale.	Australians from Victoria state (n=1000).
Maclellan, Gottschall-Pass & Larsen (2004). Canada.	Fruit and vegetable consumption: benefits and barriers.	To explore adult women's perceptions of the nutritional benefits and barriers to fruit and vegetable intake.	Face-to-face using open-ended questions.	Women living in Prince Edward Island, Canada (n=40).

Table 3.5 Continued

Authors	Title	Purpose	Study Method	Subjects
Pollard, Kirk & Cade (2002). United Kingdom.	Factors affecting food choice in relation to fruit and vegetable intake: a review.	To provide an investigation into the food choice decisions of adults in relation to fruit and vegetable intake.	Review	NA
Chuan Ling & Horwath (2001). Singapore.	Perceived benefits and barriers of increased fruit and vegetable consumption: validation of a decisional balance scale.	To fill a gap in research by developing a scale to measure the pros and cons of decision making for eating more fruit and vegetables.	Mail and telephone survey. Questionnaire included a validated fruit and vegetable food frequency questionnaire and general self-completion questionnaire.	Chinese households in Singapore (n=1200).
Cox, Anderson, Lea & Mela (1997). United Kingdom.	UK consumer attitudes, beliefs and barriers to increasing fruit and vegetable consumption.	To identify relevant beliefs and attitudes of the UK population to increasing fruit and vegetable intake.	Postal survey using a 7 point Likert scale.	2020 adults in the UK.

3.6 Pilot Study

The pilot study was conducted on the 2016 group of community service dieticians (n=24) that graduated from UKZN. As some email addresses of these students were linked to their university accounts, the emails were returned. To make up for this, seven qualified dieticians not practicing in KZN were also used to pilot the study. As the community service dieticians were recent graduates, the UKZN Department of Dietetics and Human Nutrition had access to email addresses and these were used for the pilot study. Dieticians were requested to complete the survey and provide written feedback regarding any concerns that they had regarding the technical use of the questionnaire as well as any concerns of bias, repetition and ambiguity of the questions. They were also asked to give their general opinion of the survey. From the feedback received the following changes were made:

- Section A questions regarding adult and paediatric visitations were adjusted so that if the respondent chose "other" as an option they could state that they perhaps only saw adult or paediatric patients if this was the case.
- A restriction was placed on all the questions to make them compulsory to answer before progressing to the next one.
- In section B, if respondents answered 'no' to being familiar to the terms asked, the survey setting were changed to automatically skip to the next relevant question applicable to that respondent.

Once all these changes were made, the survey system was cleared and the final survey link sent out.

3.7 Data capturing and analyses

Once all the survey responses were collected from the final sample, the data were transferred onto an Excel spreadsheet in order of responses received, from oldest to most recent. From here, those surveys that were incomplete were disregarded and only information from completed surveys was utilised. The data were analysed using the Statistical Package for the Social Sciences version 23 (SPSS) database. Tests used in the analysis included:

- Descriptive statistics such as means and standard deviations for all questions that used the Likert scale response of strongly disagree to strongly agree.
- Binomial test to determine whether a significant proportion of respondents selected one of two possible responses in the knowledge and attitude section of the survey. This was predominantly used to test whether subjects felt the diets in question were nutritionally adequate.
- One sample t-test to determine whether a mean score was significantly different from a scalar value in all Likert scale questions in the benefits and barriers section of the questionnaire.
- Independent samples t-test to determine if there was any significant difference between two population means. In particular this applied to the area of work in section A of the questionnaire to determine whether there was any significant difference between patients seen in the private versus the government sectors.
- Factor analysis was run in the benefits section of the results to determine if any latent factors were underlying the benefits. This was done using the Kaiser-Meyer-Olkin test for sampling adequacy and Bartlett's test of sphericity.

Table 3.6 provides a summary of the objectives, the variables associated with each object as well as the statistical test applied in order to analyse the results. Statistical significance was measured as $p<0.05$.

Table 3.6 Data analyses of the objective

	Objective	Variables required for analysis	Statistical test to be applied
1.	To determine the dieticians' knowledge and attitude toward a PBD.	- Plant-based definitions - Adequacy of university training - Prescription of a plant based diet in practice	- Descriptive Statistics - One sample t-test - Binomial test
2.	To determine the dieticians' opinion toward a WFPBVD.	Benefits: - Diet-disease links - Macro and micronutrient profile - Overall well-being Barriers: - Availability of information - Dietary limitations - Social influence - Cost factors - Patient reception of information	- One sample t-test - Kaiser-Meyer-Olkin test for sampling adequacy - Bartlett's test of sphericity

3.8 Data quality control

3.8.1 Validity and reliability

According to Struwig and Stead (2001, p136), validity is the extent to which a research design is appropriately conducted to measure the concept at which is aims to measure. Reliability is concerned with issues of consistency of measures. It describes how a research tool will produce similar results in different circumstances if assuming that nothing else has changed (Bryman & Bell 2015 p106; Roberts, Priest & Traynor 2006).

In order to ensure validity and reliability, the questionnaire was developed by means of a series of steps as outlined by Steyn *et al* (2006) and Terwee, Bot, de Boer, Van Der Windt, Knol, Dekker, Bouter and de Vet (2007) that are addressed in the next two sections.

3.8.2 Content validity

Content validity examines the extent to which the concepts of interest are represented in the questionnaire. The target population of the desired study should be involved in the item selection of the questionnaire (Terwee *et al* 2007). Once the first draft of the questionnaire had been developed it was sent to a panel of six dieticians who were considered experts in the field due to their work in research or academia. They were asked to rate the questions on a scale of 1-5 (from irrelevant to relevant) according to the objective of each section. From here the questionnaire was adjusted to exclude questions that were irrelevant and changes to vocabulary were made to questions that were unclear. These questions were then sent to a statistician who measured the questions against the research objectives and suggested changes. Questions were removed and the wording of certain questions changed. The benefits and barriers section of the survey was reduced from 20 questions to 12 and all questions that appeared to be repetitive were removed. A final evaluation then took place in a presentation format to a panel of five dieticians where the proposed final draft was presented. Further wording was changed from using the term PBD to a WFPBVD. This was done so that dieticians had clarity of what the study was addressing due to the term PBD being a new concept in literature. Questions that appeared biased or ambiguous were removed and the format of the demographic section of the questionnaire was adjusted. A pilot test was then conducted to test the questionnaire.

3.8.3 Reliability

In order to ensure reliability the survey was structured in such a way to ensure that questions that could not be answered or did not apply to the respondent were systematically removed from the questionnaire. Limitations were put into the online system that ensured that all compulsory questions were answered before progressing further in the survey. A further contribution to reliability was the use of questions specifically in Sections C and D that were adapted from other similar studies, in particular Lea *et al* (2006a, 2006b).

3.9 Reduction of bias

In designing the questions, bias was reduced by considering the following tips as stated by Fowler and Cosenza (2008, p139):

- Questions used terms and phrases familiar to the population group;
- No assumptions about the subject's line of work were made;
- A single question was asked at a time (Fowler & Cosenza 2008, p139).

3.10 Ethical considerations

Ethical approval was applied for and obtained through the Biomedical Research Ethics Committee (BREC) Reference number BE289/17 (Appendix B, p131). Gatekeepers' permission was acquired from ADSA in order to use the newsletter for the distribution of the survey and a copy of this can be found in Appendix C, p132.

To ensure subject confidentiality, all subjects were informed that any information provided was anonymous and that all information gathered was used solely for the purpose of the study (Appendix D and E, p133 and 135). Subjects had the right to withdraw their response at any point they wished to. An exit button was also placed on the survey should they have decided to discontinue at any point.

3.11 Summary

This chapter outlined the methodology used to determine the dieticians' knowledge, attitude and opinions toward the benefits and barriers of a WFPBVD. The data collection tool and the literature in support of this tool were outlined. The steps and literature surrounding the design of the questionnaire were presented as well as the steps taken to ensure validity and reliability of the research tool. The steps that were taken to reduce and prevent bias were also outlined in this chapter. The next chapter will focus on the results of the study according to the research objectives.

CHAPTER 4: RESULTS

This chapter presents the results of the study according to the study objectives.

4.1 The response rate and demographics of the population

While the survey was sent to 162 dieticians registered with ADSA via their weekly newsletter, the opening rate of the mail, as reported by Mail Chimp was 53.3% (n=86) with an average click rate of the survey reported at 17% (n=28). The final respondent population was 108 dieticians. From this number, seven surveys had to be disregarded due to incomplete responses or missing data. Therefore the total number of questionnaires analysed in the final sample was 101.

The sample comprised of 96 females (95%) and 5 males (5%) with a mean age of 31.87 (SD7.372) years. Respondents were predominantly White (71.3%, n=72) followed by Black African (18.8%, n=19) with the lowest response rate from the Indian (9.9%, n=10) population.

The reported years of starting to practice as a dietician ranged from 1979 to 2017 with most respondents practicing from 2009-2017 (69.3%, n=70). Table 4.1 presents the universities attended and the qualifications of the study sample. A high percentage of the sample obtained their qualification from UKZN (66.3%, n=67), followed by The University of Stellenbosch (9.9%, n=10) and The University of Cape Town (8.9%, n=9). A post graduate diploma was the highest reported qualification (59.4%, n=60) followed by honours (20.8%, n=21).

Table 4.1 Universities attended and qualifications of the study sample

		n	%
University where qualification was obtained	University of Cape Town	9	8.9
	University of Free State	3	3.0
	University of KwaZulu-Natal	67	66.3
	North-West University (Potchefstroom Campus)	3	3.0
	University of Pretoria	4	4.0
	Sefako Makghato Health Services (Previously Medunsa)	1	1.0
	University of Stellenbosch	10	9.9
	University of Western Cape	1	1.0
	Outside RSA	2	1.9
	Other*	1	1.0
Highest qualification obtained	Bachelor's degree	11	10.9
	Post Graduate Diploma	60	59.4
	Honours	21	20.8
	Masters	9	8.9

*A combination of UKZN and the University of Stellenbosch

4.2 Area of employment and patient interactions

The sample was represented by 44.6% (n=45) of government employed dieticians and 47.5% (n=48) of private practicing dieticians (PPDs) and the remaining sample comprised 7.9% (n=12). These subjects who will be referred to as "other" worked in a combination of government or private as well as academic, food service, lactation counselling, medical and pharmaceutical representatives.

Subjects were presented with reasons for adult and paediatric patient referrals and asked to rate the frequency with which these occurred on a scale from 1 which represented the patient was referred 'not at all frequently' to 5 which represented 'very frequently'. A one sample t-test was used to determine if the average frequency of referral was different from a central score of 3. In the adult population 'chronic disease of lifestyle' (M=4.31) was a reason for referral that

occurred significantly more frequently, t(100)=10.149, ($p<0.05$). In the paediatric population, although results showed significance ($p<0.05$) they also showed an infrequency of referral ($M<3$). Using the mean scores, HIV/AIDS and TB was the most common reason for referral ($M=2.50$), followed by disorders of the GIT ($M=2.42$) and NCDs ($M=2.10$) in this population.

Independent sample t-tests were used to determine whether a significant difference existed between the reasons for referral in the adult population among government and non-government dieticians (PPDs and 'other'). Only those results which were significant are reported in Table 4.2 ($p<0.05$). Government dieticians were significantly more likely to be referred patients with cancer, NCDs, HIV/AIDS and TB, liver disease and renal disease compared to non-government dieticians. This was not true for sports nutrition, where the frequency of referral ($M=2.07$) was significantly higher amongst the non-government dieticians ($M=1.11$), t(70.561)=-4.749, ($p<0.05$).

Table 4.2 The mean frequency of adult referral reasons according to area of employment

	Government Dieticians (n=45)		**Non-government dieticians (n=56)**				
Reason for Referral	**Mean**	**SD**	**mean**	**SD**	**p Value**	**t**	**df**
Cancer	3.04	1.492	2.04	1.220	**0.000**	3.658	84.507
NCD's	4.82	0.535	3.89	1.557	**0.000**	4.171	70.428
HIV/AIDS and TB	4.51	0.944	1.54	1.044	**0.000**	14.849	99
Liver Disease	2.42	1.118	1.75	0.995	**0.002**	3.193	99
Renal Disease	3.04	1.461	2.34	1.392	**0.015**	2.475	99
Sports Nutrition	1.11	0.487	2.07	1.412	**0.000**	-4.749	70.561

* p values in bold represent significance

4.3 Knowledge and attitudes regarding a WFPBVD

4.3.1 Plant based definitions and nutritional adequacy

Only one dietician in the whole sample was not familiar with the term "vegan diet". This respondent did not answer any further questions in this section. The remaining sample consisted of 100 participants and therefore the 'n' and percentage are the same. When asked to choose a definition that best defines a vegan diet a high percentage (99%) of dieticians chose the correct definition.

Using a scale from 1 representing 'strongly disagree' to 5 representing 'strongly agree', dieticians were asked to indicate their agreement that a vegan diet could be nutritionally adequate. A one sample t-test found a significant agreement with this statement ($M=3.28$) $t(99)=2.607$, ($p< 0.011$).

The term 'Whole Foods Plant Based Diet (WFPBD)' was familiar to 52% of the 100 respondents that were familiar with the term vegan diet. A binomial test reported no significant difference between the two groups who responded either 'yes' or 'no' to this statement.

For the remainder of this section of the survey, only respondents who reported being familiar with the term WFPBD were analysed (n=52). The subjects' identification of foods that comprised a minimally processed WFPBD are presented in Figure 4.1. Vegetables, fruits, legumes, nuts and seeds, whole grains, natural nut butters and coconut/olive oil were all reported to make up a WFPBVD by more than 50% of the sample. This reflects that dieticians have a good level of knowledge regarding plant based foods.

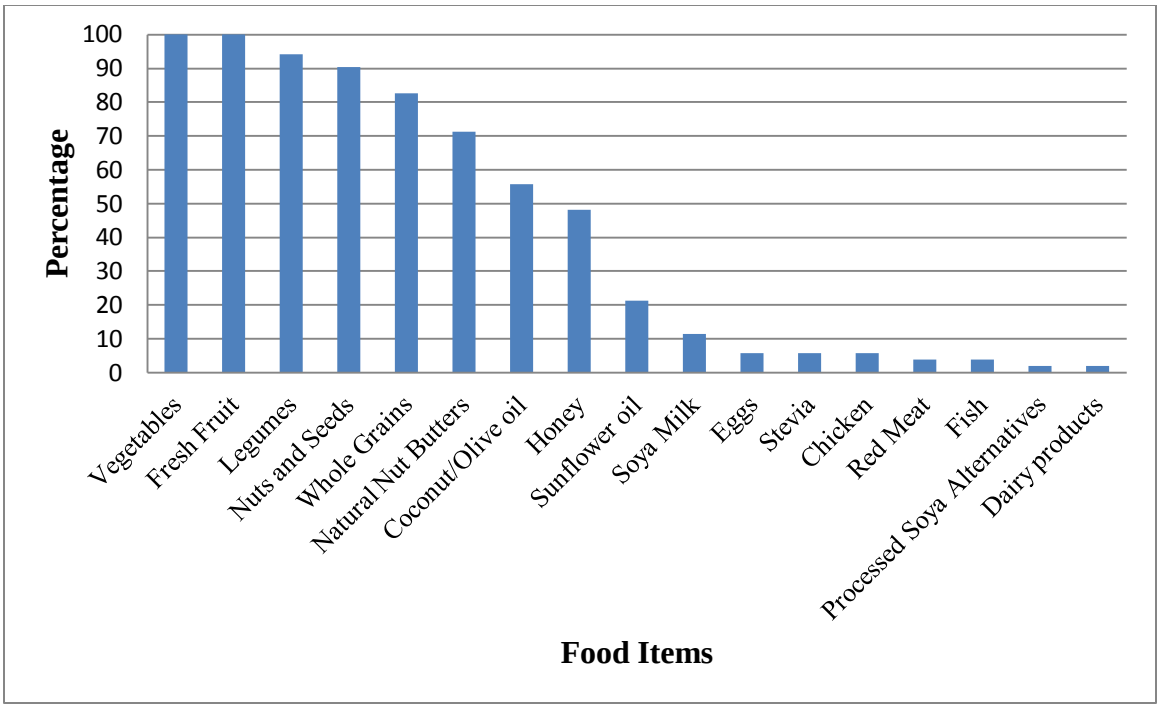

Figure 4.1 Identification of minimally processed plant based foods by sample (n=52)

A binomial test was run to determine whether a significant proportion of the subjects reported 'yes' or 'no' to the food items they thought comprised a WFPBVD. A significant number of subjects did not report dried fruit (73.1%, n= 38) and Stevia (94.2%, n=49) ($p<0.05$) as minimally processed whole plant based foods. Coconut/Olive Oil was identified as a whole plant based food by 55.8% (n= 29) of the sample however this result was not found to be significant. The whole food plant based items and the reported analyses according to the binomial test are presented in Table 4.3.

Table 4.3 Reported analyses of minimally processed whole plant based foods

Food Item	Response	n	%	p Value
Vegetables	Yes	52	100	**0.000**
Fresh Fruit	Yes	52	100	**0.000**
Dried Fruit	No	38	73.1	**0.001**
Nuts and Seeds	Yes	47	90.4	**0.000**
Legumes	Yes	49	94.2	**0.000**
Whole Grains	Yes	43	82.7	**0.000**
Natural Nut Butter	Yes	37	71.2	**0.003**
Coconut/Olive Oil	Yes	29	55.9	0.488
Stevia	No	49	94.2	**0.000**

* p values in bold represent significance

Using a scale from 1 representing 'strongly disagree' to 5 representing 'strongly agree', the sample (n=52) was asked to indicate their agreement that a minimally processed WFPBD could be nutritionally adequate. A one sample t-test found no significant agreement or disagreement to this statement (M=3.17, SD 1.043).

4.3.2 University training and prescription in practice

Questions pertaining to university training and personal use of a WFPBVD were rated on a scale from 1 representing 'strongly disagree' to 5 representing 'strongly agree'. A one sample t-test revealed that there was a significant disagreement with the statement "I was well-trained in the use of WFPBVD at university" (M=2.08, SD 0.947) ($p<0.05$). This analysis also reported significant agreements with the statements, "I am interested in improving my knowledge on WFPBVD" (M=4.08, SD 0.987) and "I am confident enough to compose a WFPBVD plan" (M=3.27, SD 0.952) ($p<0.05$).

When asked to rate the frequency of prescriptions of a WFPBVD in practice from 1 indicating 'never' to 5 indicating 'always', the binomial test revealed that dieticians were significantly more likely to rate the frequency of prescription as a 2 which indicates that is was almost never used in practice (67.3%, n=35) (p=0.018).

The open question at the end of this section allowed dieticians to state which websites would be used to obtain credible information should they wish to learn more about a WFPBVD. A significant sample stated they would like to learn more 88% (n=46), and reputable online sources were stated as the preferred research sites.

4.4 Opinion regarding a WFPBVD

This section looked at the perceived benefits and barriers of a WFPBVD as indicated by the study sample.

4.4.1 Perceived benefits of a WFPBVD

A one sample t-test reported significant agreement and disagreement for factors relating to the perceived benefits of a WFPBVD. All of the subjects (n=101) were asked to rate their agreement with the related statements on a scale of 1 representing 'strongly disagree' to 5 representing 'strongly agree'. Mean scores greater than 3 indicated a higher frequency of respondents in agreement with the statements and mean scores less than 3 indicated disagreement with the statements. The strongest perceived benefits reported were "It is associated with an improved fibre intake" ($M=4.46$) $t(100)=22.830$, ($p< 0.05$) and "It encourages a lower saturated fat intake due to reduced animal products" ($M=4.20$) $t(100)=14.816$, ($p<0.05$). The strongest disagreement was found with the statements "It is an easy diet to follow" ($M=2.27$), $t(100) =-7.603$, ($p<0.05$) and "It is a suitable option in low-income households" ($M=2.58$), $t (100) =-3.630$, ($p<0.05$). All significant results according to agreement and disagreement with the statements are reported in Table 4.4.

Table 4.4 Subjects' agreement and disagreement regarding the perceived benefits of a WFPBVD

Statements	Mean	SD	p Value	t
It reduces the risk of diseases of lifestyle.	4.02	0.678	**0.000**	15.118
It encourages a lower saturated fat intake due to reduced animal products.	4.20	0.813	**0.000**	14.816
It is associated with a lower cholesterol intake.	4.10	0.755	**0.000**	14.628
It is associated with improved fibre intake.	4.46	0.641	**0.000**	22.830
It is associated with reduced risk of constipation.	4.19	0.703	**0.000**	16.984
It encourages an increased consumption of vitamins and minerals.	3.79	0.941	**0.000**	8.455
It improves energy levels.	3.19	0.731	**0.011**	2.587
It is an easy diet to follow.	2.27	0.968	**0.000**	-7.603
Meals are quick to prepare.	2.68	0.905	**0.001**	-3.519
It is a suitable option in low income households.	2.58	1.151	**0.000**	-3.630

* p values in bold represent significance

When applying factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy test score was 0.744 which is above the recommended value of 0.6 and the Bartlett's test of Sphericity was significant ($\chi^2(66)=491.609$, $p<0.05$) which indicated that factor analysis could be applied to the available data. Two underlying factors were derived which accounted for 54.3% of the variability in the data. These factors are listed in Table 4.5 and are labelled: "Health benefits" and "Personal benefits".

Table 4.5 Pattern matrix for the benefits of a WFPBVD

Benefits of a WFPBVD	Health Benefits	Personal Benefits
It is associated with improved fibre intake.	0.814	
It is associated with a lower cholesterol intake.	0.732	
It is associated with reduced risk of constipation.	0.709	
It encourages a lower saturated fat intake due to reduced animal products.	0.698	
It reduces the risk of diseases of lifestyle.	0.631	
It encourages an increased consumption of vitamins and minerals.	0.529	
It is an easy diet to follow.		0.768
It is a suitable option in low income households.		0.745
It is affordable.		0.656
Meals are quick to prepare.		0.612
It improves energy levels.		0.509
It encourages the consumption of a greater variety of foods.		0.412
% of variance	**31.582**	**22.767**

A one sample t-test showed that there was significant agreement (M=4.13) that there were health benefits associated with a WFPBVD, $t(100)=20.198$, ($p<0.05$); while there is significant disagreement that there are personal benefits (M=2.80), $t(100)=-2.945$, ($p=0.004$). These measures showed reliability using Cronbach's alpha ($\alpha > 0.7$).

4.4.2 Perceived barriers of a WFPBVD

A one sample t-test reported significant agreement and disagreement for factors relating to the perceived benefits of a WFPBVD. Subjects were asked to rate their agreement with the related statements on a scale of 1 representing 'strongly disagree' to 5 representing 'strongly agree'. Mean scores greater than 3 indicate that a high frequency of respondents were in agreement with the statement and mean scores less than 3 indicate disagreement with the statements. The strongest barrier reported was "There is not enough awareness around whole food plant based vegan diets for the public" (M=4.06) $t(100)=12.945$, ($p<0.05$). This was followed by "People

prefer to consume meat and animal by-products" (M=4.04) t(100)=13.981, (p<0.05). Significant disagreement was found with the statements "The diet is not filling enough" (M=2.38), t(100)=-7.403, (p<0.05); and "The diet lacks variety" (M=2.71), t(100)=-3.213, (p=0.002). All significant results according to agreement and disagreement with the statements are reported in Table 4.6. No significant agreement or disagreement was found with the statements "There is not enough protein in the diet" and "The meals are difficult to prepare".

Table 4.6 Analysis of the perceived barriers of a WFPBVD

Statements	Mean	SD	p Value	t
There is not enough information about the diet.	3.50	0.879	**0.000**	5.661
People prefer to consume meat and animal by-products.	4.04	0.747	**0.000**	13.981
The diet may cause indigestion, bloating, gas or flatulence.	3.27	0.871	**0.003**	3.086
The diet is difficult to follow in social settings.	3.95	0.829	**0.000**	11.520
There is resistance from friends and family to follow the diet.	3.86	0.800	**0.000**	10.816
Ready to eat plant based vegan meals and snacks are not easily accessible.	3.74	0.966	**0.000**	7.726
There is not enough awareness around whole food plant based vegan diets for the public.	4.06	0.822	**0.000**	12.945
The diet is not filling enough.	2.38	0.847	**0.000**	-7.403
The diet lacks variety.	2.71	0.898	**0.002**	-3.213

* p values in bold represent significance

4.5 Summary of results

The statistical analyses of the results of the questionnaire used to determine the dieticians' knowledge, attitude and opinion toward the perceived benefits and barriers of a WFPBVD were presented in this chapter. The following results were important:

A total of 101 dieticians were included in this study. This was made up of 96 females (95%) and 5 males (5%) with a mean age of 31.87 (SD7.372) years. Respondents were predominantly White (71.3%, n=72) followed by Black African (18.8%, n=19) and the majority had qualified at

UKZN (66.3%, n=67) with a post graduate diploma as the highest reported qualification (59.4%, n=60).

The bulk of the sample was represented by 44.6% (n=45) of government employed dieticians and 47.5% (n=48) of private practicing dieticians (PPDs). In the analysis for reasons behind patient referrals it was found that statistically more adults were referred for chronic diseases of lifestyle, with no significant reasons for referral in the paediatric population. Government dieticians were significantly more likely to have patients referred with cancer, NCDs, HIV/AIDS and TB, liver and renal disease.

The term 'vegan diet' was familiar to 99% (n=100) of the population with 51.5% (n=52) being familiar with the term 'whole foods plant based vegan diet'. The subjects significantly identified six out of a possible nine whole plant based foods indicating a good understanding of a WFPBD. While there was significant agreement that a vegan diet can be nutritionally complete, a vegan diet consisting of minimally processed whole plant based foods was not reported to be nutritionally adequate. Dieticians reported that they were not well trained in the use of a WFPBVD at university level but that they would be interested to learn more about the diet.

The strongest perceived benefits of a WFPBVD reported "It is associated with an improved fibre intake", "It encourages a lower saturated fat intake due to reduced animal products" and "it is associated with reduced risk of constipation". The strongest disagreement was found with the statements "It is an easy diet to follow" and "It is a suitable option in low-income households". The benefits were divided into two categories namely 'health benefits' and 'personal benefits'. Significant agreement was found with the health benefits associated with a WFPBVD while significant disagreement was found with the personal benefits.

The strongest barrier reported to a WFPBVD was, "There is not enough awareness around whole food plant based vegan diets for the public". This was followed by "People prefer to consume meat and animal by-products". Significant disagreement was found with the statements "The diet is not filling enough" and "The diet lacks variety".

A discussion of the results from this study in relation to other similar studies conducted and the findings thereof will be presented in the next chapter.

CHAPTER 5: DISCUSSION

The purpose of this study was to address the possibility of using a WFPBVD in the management of NCDs. This was done by determining the knowledge, attitude and opinion of KZN dieticians towards a WFPBVD. This chapter will focus on discussing the results of the objectives presented in chapter four in relation to the literature surrounding these objectives.

5.1 The response rate and demographic characteristics of the population

The study was completed by 101 respondents. Although the ADSA newsletter was sent to 162 dieticians, only 17% of this sample clicked on the survey link in the initial newsletter. Upon request, a follow up email was sent which slightly increased the response rate. According to Eysenbach and Wyatt (2002), contact with the participants and personalized contact may improve response rate of surveys, however due to confidentiality rules that govern the KZN ADSA branch this was not possible. Furthermore, access to personal email addresses was not permitted and this limited the ability to personally follow up with emails.

The response in a 2012 study by Visser, Mackenzie and Marais using South African Dieticians reported a low nationwide response rate of 22.5% (n=340) when contacted via email and post for a two part survey questionnaire. Similarly Howard *et al* (2013) and Hetherwick *et al* (2006) reported a 40% and 14.7% response rate using web based surveys with dieticians, respectively. A study conducted on Dutch consumers using a web based survey however showed a 68% response rate within two weeks and a 49% response rate was shown in the Australian public on a meat reducing diet study (Schösler, de Boer & Boersema 2011; Hayley, Zinkiewicz & Hardiman 2015). This may indicate that health professionals have less time available or may experience survey fatigue and therefore do not wish to complete online surveys.

The study was predominantly completed by female dieticians (95%, n=96). Across studies observed using dieticians as the sample, females are reported as the dominant gender which may reflect dietetics as a female dominant profession. Similar findings were reported by Howard *et al* (2013) who had a 94% female response rate, Campbell and Crawford (2000) reported a 93% female response rate and Visser *et al* (2012) reported a 97.5% female response rate.

More than two thirds of the sample (66.3%, n=67) obtained their qualification from UKZN. As this study was conducted using dieticians in the KZN province this result was not unexpected. UKZN is the only university in South Africa that offers a three year degree, followed by a one year post graduate diploma qualification. Therefore the post graduate diploma was listed as the highest qualification for most of the sample (59.4%, n= 60).

5.2 Area of employment and patient interactions

Across the sample in the adult population, NCDs was reported as the most common reason for referral. This is in accordance with the 2015 Statistics South Africa report that indicated 52.7% of deaths in 2014 were caused by these diseases (Statistics SA, 2017b). The comparison of government and non-government referrals revealed that cancer, NCDs, HIV/AIDS and TB, liver disease and renal disease were significantly greater areas of concern in the government sector. Patients that attend government hospitals are generally those that come from low socio-economic backgrounds and therefore cannot afford private care. The implications of this may reflect the disposable income they have to spend on fruits and vegetables which are generally considered more expensive then processed foods. From this, food garden education could be of vital importance to create a sustainable, healthy food source.

Sports nutrition is not a common field of nutrition seen in the government sector and therefore it is unsurprising that this was seen significantly more by dieticians in the private sector.

5.3 Knowledge and attitude regarding a WFPBVD

5.3.1 Plant based definitions

While all dieticians except one respondent correctly defined the term vegan, 48% (n= 49) were not familiar with a WFPBD. This is perhaps due to ‘Vegetarianism’ being such a broad term which encompasses so many different definitions. There also appears to be a non-uniform use of terminology in research which further adds to the complexity of the topic (Cramer, Kessler, Sundberg, Leach, Schumann, Adams & Lauche 2017). The American Dietetic Association (2016) includes both vegetarian and vegan diets under the definition of a PBD whilst the American Physicians Committee defines a PBD as a vegan diet only (Hever 2016).

No recent studies could be identified that tested dieticians knowledge on specific terminology. However a 1999 study that tested knowledge and attitudes of 182 American dieticians found that those who were currently, or who had previously followed a vegetarian diet, had higher knowledge and attitude scores than those that had never followed a vegetarian diet (Duncan & Bergman 1999). A 2002 study conducted by Barr and Chapman that addressed current, former, and non-vegetarian women found that a high percentage of self-defined vegetarians consumed fish. This misinterpretation of the term vegetarian emphasises the importance of a universal definition for the term as well as the need for caution regarding the interpretation of the term in literature (Barr & Chapman 2002). The sample was asked about the nutritional adequacy of a vegan diet and a vegan diet particularly made of whole plant based foods. There was a significant agreement within the sample that a vegan diet could be nutritionally adequate, however there was a neutral response that a vegan diet made up of whole plant based foods could be nutritionally adequate. Again, this lack of understanding emphasises the importance of a standardised definition as a vegan diet that is not whole food plant based, may in fact allow for more nutritional deficiencies particularly when it is low in fruits and vegetables and high in processed grains and meat alternatives. The ADA (2016) stated the following regarding vegetarian diets: "It is the position of the Academy of Nutrition and Dietetics that appropriately planned vegetarian, including vegan diets are healthful, nutritionally adequate, and may provide health benefits for the prevention and treatment of certain disease (Melina *et al* 2016)."

In the identification of minimally processed whole plant based foods, the average score reported was 67%. Although this study is the first of its kind in South Africa, an American study addressing dietician's perception of plant protein quality found that dieticians were generally supportive of PBDs but that knowledge of plant based proteins could be enhanced (Hughes, Kress, Armbrecht, Mukherjea & Mattfeldt-Beman 2014). This section of the survey was only completed by those dieticians who were familiar with the term WFPBD which reflects an average understanding of both the diet itself and which foods can be prescribed in a practice environment. Therefore more training on this diet could be beneficial for all dieticians who have the desire to use it in practice.

5.3.2 Prescription in practice

Education and prescribing information on many varieties of diets is an important part of a dieticians job and the results of this study shows that a significant portion of this sample (75%, n=39), felt that they did not receive sufficient training at university level on a WFPBVD. An older reported study by Duncan and Bergman (1999) found that only 31% of dieticians felt that their education had adequately prepared them for prescribing vegetarian diets and 48% felt that they were inadequately prepared. Although the sample felt that their training was inadequate, veganism and PBDs are emerging topics of interest in literature and relatively new concepts. Universities in South Africa have a set curriculum that is governed by the HPCSA and using the FBDG as a means to educate patients is seen as the gold standard. This topic is therefore not yet a large focus; however it may be beneficial to include the components of a WFPBVD into basic nutrition courses. Although the bulk of respondents felt that they were inadequately trained at a University level, there was a significant amount of confidence in prescribing a WFPBVD meal plan and significant interest in improving knowledge regarding this lifestyle.

Only 37% of dieticians stated that they would consume a WFPBVD if there was overwhelming scientific support for this lifestyle. This same question regarding PBD was proposed to 136 American dieticians in a protein quality study and it was found that 102 respondents had already tried to move more toward the consumption on a PBD. This may be linked to a larger amount of available information and discussion regarding PBDs at an international level (Hughes *et al* 2014).

Lee *et al* (2015) surveyed 25 healthcare providers including 13 dieticians in a community education clinic in Canada. Questions related to their awareness and perception of a PBD in the treatment of Type 2 Diabetes. Results showed that although 72% were aware of the benefits of the diet, only 32% recommended it to patients. This is similar to the current study where results showed a neutral response to the nutritional adequacy of a WFPBVD and prescribing it in practice when appropriate was reported as “almost never”. Ball, Eley, Desbrow and Ferguson (2015) conducted a study to establish the personality traits of Australian dieticians and found that dieticians were cautious in their decision making practices and had high levels of harm avoidance. This ensures that high professional standards and patient care practices were

maintained which can also be applied to these subjects. This may also explain hesitation at prescribing a PBD.

The open question revealed that most dieticians would use reputable sources to gain more knowledge on the topic of WFPBVD and that 88% (n=46) were interested in learning more about WFPBVD. The most common sources of information included scientific websites such as Practice based Evidence in Nutrition: PEN, PubMed, Science Direct, Google Scholar, Medsearch and the South African Journal of Clinical Nutrition. After scientific websites, the next most common place cited to gain more information was from nutritional organisations such as ADSA, ADA, the vegan society and the British Dietetic Association.

Cramer *et al* (2017) questioned 648 American vegetarians and vegans who had been following this diet for more than 12 months and found that 6.3% had consulted with a practitioner for guidance. The most common methods of research on the diet included the internet (44.6%); books, magazines, newspapers (41.2%); health food stores (27.6%) and scientific articles (22.2%). Similarly, a study that assessed 136 American dieticians' opinions of plant based protein quality found that the most common sources of information on protein quality was university training, ADA communications, scientific journals, government agencies, professional meetings, the internet and continuing education classes (Hughes *et al* 2014). With the amount of misinformation that is available on the internet from non-scientific sources it is essential that health professionals utilise the correct research methods to obtain accurate information. According to the ADA, dieticians must have an adequate knowledge of and access to nutritional tools (Melina *et al* 2016).

Dieticians are expected to be experts in the field of nutrition and to continuously update their nutrition knowledge. The review of literature in Chapter 2 showed that a WFPBVD has the potential to be nutritionally adequate. In an American study conducted on 609 Seventh-day Adventists regarding reasons for following various vegetarian diets, it was found that nutrition knowledge and attitudes toward a vegetarian diet influenced each other. An increase in nutritional knowledge may lead to a positive attitude toward a vegetarian diet and vice versa. This report indicated that a positive attitude toward a vegetarian diet is knowledge based rather than being based on traditional beliefs or misconceptions (Pribis, Pencak & Grajales 2010).

5.4 Opinions regarding a WFPBVD

This study addressed the opinions of dieticians toward a WFPBVD by looking at the benefits and barriers of this diet.

5.4.1 Perceived benefits of a WFPBVD

The results of this current study can only be compared to those of Lea *et al* (2006) where the public views of the benefits of a PBD were addressed in Australia as this is currently the only similar study conducted of its kind. However, there are studies that have been conducted on general behaviours and attitudes towards diet and these will be drawn on for comparison purposes.

Mixed responses regarding the benefits of a WFPBVD were noted in the current study with similarities in agreement presented by Lea *et al* (2006). The greatest benefits of a WFPBVD reported in the current study included 'increasing fibre intake' (97%, n=98) and 'association with a decreased saturated fat intake' (91%, n= 92) which were also reported to be the highest reported benefits found by Lea *et al* (2006) in the Australian public. The benefits that received the lowest agreement included, 'it is an easy diet to follow' and 'it is suitable in low income communities'.

It is noteworthy that there was higher agreement with the health benefits of a WFPBVD than the personal benefits. These personal benefits included the ease of the diet to follow and the quick preparation of meals. This was similarly reported by Lea *et al* (2006) where health benefits ranked higher than non-health related benefits although environmental benefits were included in the non-health related benefits. A possible explanation for this may be that dieticians have good scientific knowledge surrounding the benefits of plant based foods; however putting that knowledge into practical application may be unfamiliar and therefore interpreted as being difficult. Providing more training from a practical perspective may therefore be beneficial to this subject group.

It is also important to note that there was significant agreement with the statement 'It reduces the risk of diseases of lifestyle'. As noted in chapter two, a WFPBVD is associated with a reduction in risk factors associated with type 2 diabetes and heart disease. Although dieticians also stated

in section 2 of the questionnaire that they were unlikely to prescribe this diet in practice, this finding that they agreed with the health benefits of a WFPBVD is important for future training opportunities. Although scientific knowledge among the sample group regarding PBDs was good, perhaps behaviour change is the hindering factor to prescribing this diet and future programs could be designed to address this.

A significant agreement was noted for the WFPBVD being associated with an increased consumption of vitamins and minerals (72%, n=73). Although the diet may be associated with an increased intake of fruit, vegetable and whole grains the public has perceptions about these foods too. A face-to-face interview was conducted on 40 women from Prince Edward Island in Canada regarding their perceptions of fruits and vegetables. The benefits listed were less health related and more general such as "feeling good", "feeling better" or "having more energy" (Maclellan *et al* 2004). This would appear to the public as a personal benefit rather than a health benefit as presented in the current study which emphasises the importance of educating the public regarding health benefits of plant based foods.

In an Australian study, only 19% of the study population agreed with the statement that a PBD could help save money (Lea *et al* 2006) while Maclellan *et al* (2004) in Canada reported cost as a major barrier to increasing fruit and vegetable intake. The current study too suggests cost and suitability in low income communities as more of a barrier than a benefit to the adoption of this lifestyle. With regards to fruit and vegetable intake, Pollard *et al* (2002) reported that consumers need to be educated on how to buy affordable food as cost is a major limiting factor to health eating practices and a WFPBVD can in fact be done affordably with appropriate education.

5.4.2 Perceived barriers of a WFPBVD

The highest reported barriers to the consumption of a WFPBVD were the public's lack of awareness (84%, n=84) and that people prefer to consume animals and animal products (82%, n=83). Similarly, Australian researchers Lea *et al* (2006) reported the strongest barriers to the public as "I need more information about PBD" and "I do not want to change my eating habit or routine". According to the current study, the diet lacking variety and not being filling enough were not seen as barriers to a WFPBVD.

A study conducted in seven rural American communities reported barriers to healthy eating. The highest reported barriers included lack of time, cost of healthy food, adjusting food habits and lack of access to healthy food (Seguin, Connor, Nelson, LaCroix & Eldridge 2014). While the accessibility to healthy, fresh foods and education regarding healthy eating may be more accessible to the middle and higher class South African population, the cost of foods may still be the restricting factor to a WFPBVD.

5.4.2.1 Cost of healthy food

The affordability of foods in low income communities has been an important area of study in South Africa. The cost of moving to a WFPBVD was a major concern in the current study perhaps because 65% of the KZN population live in poverty (Statistics SA 2017). According to Pretorius and Silwa (2011), poverty and high levels of food insecurity are the biggest barriers to the application of the FBDG and therefore may also be a barrier to consuming a WFPBVD. According to this 2011 study, the cost of consuming a healthy diet using the FBDGs in Soweto was compared to the diet typically followed which was not in line with the FBDGs. By contrasting the two diets using 2011 prices it was found that the daily intake on average cost R18.42 per day, whilst a healthy diet could cost R17.72. This was done by adjusting the traditional intake of processed meats, dairy, refined carbohydrates and sugars with wholegrains, fruit, vegetables and legumes (Pretorius & Silwa 2011). A similar study conducted in the Western Cape found that when commonly consumed foods in rural towns were replaced with their healthier alternative, the diet became considerably more expensive (Temple, Steyn, Fourie & De Villiers 2011). According to Drimie, Faber, Vearey & Nunez (2013), changing to a healthier diet in rural communities would cost on average 69% more than the unhealthy food choices currently being made. While the cost of healthy food is one factor to consider, the availability of these foods is another. The majority of the rural South African population may not have access to foods such as fruits, vegetables and wholegrain foods as stores may only stock limited amounts of these products (Temple *et al* 2011). The cost factor of then travelling to a local supermarket as well as the ability to store these food items appropriately may act as a barrier to the adoption of this lifestyle. Education on the diet and creating cost effective methods of making this lifestyle sustainable is important.

5.4.2.2 Lack of information

Lee *et al* (2015) reported that a lack of clear clinical practice guidelines and diet-specific educational support was a major barrier to implementing a PBD in a diabetic clinic in Canada. This finding regarding a lack of public awareness in the current study is therefore relevant to the food industry and health professionals in ensuring that more information becomes available to the public and more research is conducted in the scientific community. It is not surprising that people enjoy consuming foods that they are brought up with and are familiar with and finding ways to overcome this barrier would be an interesting topic of research.

5.4.2.3 People prefer to consume meat and animal by-products

In the current study the statement, "people prefer to eat meat and other animal by-products" was reported as the second highest barrier (82%, n=83). This was an expected response to this statement as the South African population, with its many diverse cultures, consumes a large amount of red meat, chicken and fish (Drimie *et al* 2013). According to Loughnan, Bastian and Haslam (2014), the decision for an individual to eat meat may come from a sense of belonging to a specific cultural group and the endorsement of the group values. For many men, meat consumption may also be tied to masculinity and its consumption may make them feel like "real men" (Loughnan *et al* 2014). A 2015 study conducted on 202 Australians had a similar finding when studying men. The researchers found that women were more likely to have a positive attitude toward reducing red and white meat intake (chicken, turkey) than men were (Hayley *et al* 2015). The topic of removing meat from the diet or the willingness to reduce meat intake is complex with many underlying psychological factors. Feelings of grief which were associated with an emotional connection to meat were found when 410 Portuguese consumers were asked about not eating meat. Consumers also reported that they would feel weak should they be required to remove meat from their diets (Graca, Oliveira & Calheiros 2015). This confirms that the response from this study stating that dieticians feel people prefer meat and animal by products is accurate and that it is a complex issue worth considering. Removing meat from the diet without any ideas of how to replacethis gap on the plate may be seen as a dietary limitation to the adoption of this diet.

5.4.2.4 General dietary limitations

Most of the study sample disagreed with the statement "the diet is not filling enough" as a perceived barrier to this lifestyle which was also found by Lea *et al* (2006). The current study sample agreed significantly that a barrier to a WFPBVD is the causation of bloating and gas whereas Lea *et al* (2006) found that this was not much of a concern in their study population. This may be linked to dieticians being more educated on the role of legumes in a PBD and the physiological effects they may have on certain individuals whereas the general public may not have the same awareness. Former vegetarians (n=35) were asked why they returned to omnivorous patterns and the most common reasons cited included health reasons such as weakness, fatigue and anaemia. Other reasons included not getting enough protein, and that it is too time consuming to eat as a vegetarian (Barr & Chapman 2002). While dieticians in the current study did not feel that protein was a significant issue, it was a significant reported barrier that ready to eat meals and snacks are not easily accessible to the public (68%, n=69). The public may be unaware of how to incorporate new foods into their diet or may be unwilling to experiment with new foods and in this way the WFPBVD diet may not be appealing.

5.4.2.5 The diet lacks variety

A WFPBD is an eating pattern that encompasses many different foods and allows for many combinations of foods and flavours. While 52% of the study population stated that the diet itself does not lack variety, when put into context of rural communities this may indeed be the case. This is because the general rural diet is composed of basic, affordable foods that may limit variety. When compared to South African studies that have addressed typical food consumption patterns in communities and the general population, it was found that the current diet lacks a variety of food and therefore increases the risk of nutrient deficiency. A 2011 study found that the main food groups consumed in South African adults based on a 24 hour recall were cereals/roots, meat/fish, dairy and vegetables. In contrast the most neglected food groups were vitamin A rich fruit and vegetables, legumes and nuts, which all form part a WFPBVD (Labadorios, Steyn & Nel 2011). The high consumption of meat and fish in this study was surprising as the cost of these foods is generally high which means that these foods are seen as a priority over more affordable protein (legumes) and high fibre foods such as fruit and vegetables.

This emphasizes the importance of improving knowledge and skills to encourage a nutritionally adequate dietary intake.

Similarly, the main findings of a review of dietary surveys in the adult South African population from 2000 to 2015 found that fruit, vegetable and dairy products were the most commonly deficient food groups (Mchiza, Steyn, Hill, Kruger, Schonfeldt, Nel & Wentzel-Viljoen 2015). While this can be linked to the poor accessibility of these foods in the rural communities, formal residents in Johannesburg were studied and dietary diversity was also found to be low among this population. While accessibility may be a problem in the rural areas, taste and convenience in urban dwellers may be a barrier to the consumption a healthier diet (Drimie *et al* 2013). The challenge therefore is how to improve dietary diversity whilst ensuring that foods are both affordable and accessible in all communities. These foods also need to be acceptable and easily incorporated into the diets across all social groups.

5.4.2.6 Social influence

Many dieticians agreed with the statements "the diet is difficult to follow in social situations" and "there would be rejection from family". In fact, of all the barriers from the current study, social influence of family members and availability of foods were the highest reported barriers to adopting a WFPBVD. "My family/partner won't eat a PBD" and "plant-based meals or snacks are not available when I eat out" were also reported as top barriers by Lea *et al* (2006). Maclellan *et al* (2004) reported similar findings regarding fruit and vegetable intake in women. The main barriers included lack of knowledge, socio-environmental factors (influence of family members, childhood experiences), and availability of foods. A high percentage of what is known about foods in adulthood is from the way they ate as children and this can have a positive or negative effect on health and decision making. Making changes to habits requires behaviour change and behaviour change requires education.

According to Lee *et al* (2015), barriers to the consumption of a PBD according to 25 medical staff members working in a Canadian diabetic clinic, had a similar outcome to the current study. The most commonly cited barriers in this Canadian study included: (1) the diet is not realistic and too difficult to adhere to, (2) there is a low perceived acceptance from patients and (3) there is a lack of guidelines regarding a PBD. While these were reported by staff members, the top two

barriers listed by 98 patients in the clinic included: (1) difficulty in changing family eating habits and (2) lack of meal planning skills (Lee *et al* 2015). This emphasises the importance of the role of the dietician in educating the general public about the diet as well as encouraging change to patients by including family members in the consult.

5.5 Summary

Chronic diseases of lifestyle were reported significantly as a major area of referral in the adult population and therefore of concern across the profession. While the majority of the sample was familiar with a vegan diet, only half were familiar with the term WFPBD. A significant portion of the sample reported that they felt they did not receive adequate training on PBDs at university level but they would be interested in improving their knowledge and they were confident enough to prescribe this kind of meal plan in practice.

The health benefits of a WFPBVD were reported as significantly more important than the personal benefits of this lifestyle which is reflective of the sample population being experts in nutrition. The most important perceived benefits reported were “It is associated with improved fibre intake”, and “It encourages a lower saturated fat intake due to reduced animal products”. The greatest perceived barriers to the adaptation of a WFPBVD according to this study included, “There is not awareness around WFPBVD to the public” and “People prefer to consume meat and animal by- products.

The conclusion and recommendations based on the findings of this study will be presented in the following chapter.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The increased prevalence of diet related obesity and NCDs in South Africa calls for action from health professionals due to the negative implications that they have on health. Urbanisation has seen the replacement of traditional eating patterns and is associated with an increase in total fat intake, animal products and a reduction in fibre intake.

Whilst PBDs are an emerging topic of interest and a precise definition is still lacking, the emerging research has shown many benefits from this dietary lifestyle. Plant based foods and a reduction of animal product consumption has shown to be beneficial in the prevention and treatment of obesity, CVD and type 2 diabetes. These diets require careful planning in order to be nutritionally adequate and the role of the dietician is crucial in this regard. Although the term PBD is relatively new, internationally there has been a growth in research trends surrounding this topic as people become more health conscious and ethically aim to reduce their consumption of animal products and by-products. There is a paucity of knowledge surrounding this topic in South African literature and this makes the research even more compelling in its possible application to the South African public. Dieticians are referred to as experts in the field of nutrition and keeping up to date with changing science is an important aspect of the profession. Therefore the purpose of this study was to determine the attitude and knowledge as well as the opinion of KZN dieticians toward the perceived benefits and barriers of a WFPBVD. This was done to determine whether a WFPBVD could be used in the management of NCDs.

This chapter will conclude the results of the study in conjunction with the objectives presented. It will also present the limitations of the study, recommendations for future practice as well as implications for further research.

6.2 Conclusions of the study

6.2.1 Knowledge and attitude regarding a WFPBVD

Dieticians were found to have a high level of knowledge regarding terminology and the identification of plant based foods. Although subjects felt that they had not received adequate training at university level on the use of PBDs in practice, a high percentage felt comfortable in

prescribing the diet to a patient. The significant number of subjects reporting interest in learning more about WFPBVDs reflects a positive attitude toward the diet and this coupled with a good understanding of the diet makes it a possible treatment option in the management of NCDs.

6.2.2 Opinion regarding a WFPBVD

The opinion of dieticians in this study was measured by addressing the benefits and barriers of a WFPBVD. In particular the benefits included health and personal related statements while the barriers included availability of information and personal related statements. While dieticians agreed with the health benefits associated with the diet, there are barriers that cannot be overlooked in application to the South African context. This includes the affordability of the diet, resistance to changing dietary habits and the suitability of this diet in low income communities. Based on this, although the general opinion was positive, the barriers may make this diet difficult to implement in the management of NCDs, particularly in poverty stricken parts of SA.

6.3 Study limitations

The protection of personal information act (PoPI) does not permit the sharing of personal details when an individual belongs to an organisation. For this reason, personal access to the mailing list of HPCSA registered dieticians was not permitted. The survey link was therefore sent out as part of a weekly newsletter to all ADSA members. Unfortunately, there was a low opening rate of the newsletter and only 53% of the population opened the email on both occasions that it was sent out. Permission to attend a Department of Health meeting to improve participation in this study was unfortunately denied. Obtaining the desired response rate in order to have a statistically reflective population was therefore not possible due to limited access to contacts.

Although being a member of ADSA does provide many benefits, the low percentage of dieticians registered with the association may encompass a variety of factors. An annual fee is required to become a member which many dieticians may be unwilling to pay. There are four ADSA meetings a year which may not be in a location suitable to dieticians living on the outskirts of Durban or Pietermaritzburg where these meetings are generally held. Another severe limitation to this study was time. As ADSA only hosts four meetings a year it was not possible to attend any of these meetings during the period from ethics approval to data collection as the university emphasises completion of masters in a one year period.

6.4 Recommendations based on the results of the study

This section will look at the recommendations for dietetic practice in improving scope of knowledge with regard to implementing a WFPBVD diet affordably. It will look at undergraduate training and research involvement as well as recommendations for government in the battle against NCDs.

6.4.1 Recommendations for dietetic practice

The interest in vegan diets and plant based nutrition is growing in popularity on an international level as individuals become more health conscious and concerned about environmental issues and animal rights. Research in this topic has also grown as more studies are being conducted showing the benefits of a PBD in the prevention and treatment of NCDs. Although South Africa has a diverse culture with people from many different backgrounds and socio-economic statuses, it is vital that dieticians stay up to date with emerging topics of interest. In a private practicing capacity, the association with clients from middle to higher income bracket is more likely. There is a higher possibility that some of these clients will be well researched in emerging health topics and may show interest in adapting a PBD. Furthermore, with cost of the diet being an area of concern in the present study, these clients may have more disposable income and be more willing to adapt this lifestyle. This emphasises the importance of dieticians to then be equipped to provide clients with the latest and up to date research as well as being in the possession of educational materials for them. The study also showed that in terms of diet there may be resistance to change and therefore providing clients with motivation and encouragement to want to improve well-being would be beneficial. With a low percentage of dieticians registered with ADSA it is important for the association to revise its policy and make changes that will encourage more dieticians to register.

On a government level, because clients may come from a lower income bracket, understanding how to prescribe PBDs to patients in an affordable and sustainable way is vital. This however can only be done if dieticians themselves are aware of how to do this. This may be in way of incorporating food gardens into community projects to increase the intake of vegetables and provide a sustainable source of food.

6.4.2 Undergraduate training for dieticians

The basic principles of nutrition and the treatment of patients are all taught at university level yet most of the study sample reported that they were not well trained in the use of PBDs. This may indicate a topic that can be incorporated into the learning syllabus across universities in South Africa. While the topic of vegetarian nutrition is not new and encompasses a variety of sub divisions, the concept of a PBD being used in the treatment of NCDs should be taught. As more research emerges this could be an ideal topic to be incorporated into literature reviews and into cooking classes. Transitioning away from a meat and dairy containing diet can be complex and therefore guiding the future dieticians how to do this in the most affordable, sustainable and balanced manner can be beneficial in the management of NCDs. Education on food gardens in rural communities is also something that should be emphasised as a way to encourage this lifestyle in the lower income communities.

6.4.3 Research involvement of dieticians

Many dieticians listed reputable sources of where they would obtain their information from should they wish to learn more about a WFPBVD. Research is often something that is very individualised and although dieticians are required to have knowledge around many topics of nutrition, there are some areas that interest some more than others. Therefore conducting research on topics that may not be interesting can be a tedious task. It would be beneficial to host meetings and conferences that appeal to dieticians. Here, speakers who are specialised regarding PBDs could present up to date research and address questions and concerns surrounding this diet. While CPD activities are a means of encouraging dieticians to stay up to date with their knowledge, these points can often be attained by reading articles that are of no particular interest to the dietician.

6.4.4 Recommendations for government

Internationally there is a shift toward the consumption of a PBD with many governmental organisations behind this movement. The benefits are not only seen in improved health status, but a shift to a PBD has also been linked to reducing hunger by increasing global food supply and a reduction in waste of natural resources, particularly water. In a country with such a large percentage of unemployed and underprivileged communities, South African government

organisations should be looking at ways to save money and feed the poor at the same time. Animal agriculture is one such obstacle which uses large areas of land that could rather be used to grow crops and feed to the poor.

In terms of natural resources, animal agriculture uses excessive amounts of water which is a major concern as South Africa is experiencing droughts across the country. A simple change in diet may reduce the demand for animal products which would reduce the need to supply the product and use large amounts of scarce resources in the production process.

Global warming is a topic of interest internationally and South Africa is one such country that has pledged to make changes to reduce its impact on climate change. Changing to a PBD is one such way in which this can be achieved yet there has yet to be any mention of this from a government level. It is vital that more research is done into this area of interest and that findings are relayed to the government about small changes that can be made.

6.5 Recommendations for future research

Clinical trials have been conducted internationally where PBDs have been compared to the prudent diet for weight loss, diabetes and CVD. This has yet to be done in South Africa and as the incidences of NCDs continue to increase it may be beneficial to conduct this type of study. Important aspects to consider should such a trial be conducted are the length of the study, size of the group, dietary restrictions of the control group and physical activity. These considerations are based on current research where results were seen in a short period of time in small groups which are perhaps easier to manage. A larger scale study would be ideal which included a 6 or 12 month follow up to determine the sustainability of the PBD on the experimental group. As PBDs have been linked to greater feelings of satiety, a study that allowed for unlimited calories of plant foods verse a calorie restricted diet on weight loss would be an interesting area of research. This could have implications for future dietary guidelines.

Another area of research is could involve surveying the South African public to determine their opinion on adopting a PBD. The results of a study of this nature would be vital for future policy makers in drawing up guidelines to healthy eating. A comparison between the different racial and income groups would be beneficial as culture has a major influence over dietary beliefs and behaviour. The ability to draw comparisons about the diet according to the diverse South African

population would also provide dieticians with clarity regarding the prescription of diets in practice.

A study that investigates the cost and sustainability of a PBD verse the traditional diets consumed across the country would allow for cultural specific recommendations. Incorporating the acceptability of this diet in the various groups would also be of interest to the health professional. The common misconception is that the diet is expensive and finding ways that make the diet culturally acceptable and affordable across income groups would be beneficial.

It would also be beneficial to conduct a study looking at ADSA to determine why such a small percentage of dieticians are registered with the association and investigate ways to improve this.

REFERENCES

Abrahams Z, Mchiza Z, Steyn NP (2011). Diet and Mortality rates in Sub-Saharan Africa: Stages in the nutrition transition. **BMC Public Health** 11(801): 1-12.

ADSA (2017). http://www.adsa.org.za/AboutUs/ADSAvisionandmission.aspx (Accessed 16/11/2017).

Alberti KGMM, Shaw PZJ (2006). Metabolic syndrome- a new world-wide definition. A Consensus Statement from the International Diabetes Federation. **Diabetic Medicine** 23(5): 469-480.

Allen L, Williams J, Townsend, Mikkelsen N, Roberts B, Foster N, Wickramasignhe K(2017). Socioeconomic status and non-communicable disease behavioural risk factors in low income and lower-middle-income countries: a systematic review. **Lancet Global Health** 5:277-289.

Allen E, Seaman C (2007). Likert Scales and Data Analysis. **Quality Progress** 40(7): 64-65.

Anderson JJB, Nieman DC (2016). Diet Quality- The Greeks Had It Right. **Nutrients** 8: 1-7.

Appleby PN, Thorogood M, Mann JI, Key TJ (1998). Low body mass index in non-meat eaters: the possible roles of animal fat, dietary fibre and alcohol. **International Journal of Obesity** 22: 454-460.

Bach-Faig A, Berry EM, Lairon D, Reguant J, Trichopoulou A , Dernini S, Medina FX, Battino M, Belahsen R, Miranda G, Serra-Majem L (2011). Mediterranean diet pyramid today. Science and cultural updates. **Public Health Nutrition** 14(12A): 2274-2284.

Ball L, Eley DS, Desbrow B, Ferguson M (2015). A cross-sectional exploration of the personality traits of dietitians. **Journal of Human Nutrition and Dietetics** 28(5): 502-509.

Barnard ND, Cohen J, Jenkins DJA, Turner-McGrievy G, Gloede L, Green A, Ferdowsian (2009a). A low fat vegan diet and a conventional diabetes diet in the treatment of type 2 diabetes: a randomised, controlled, 74-wk clinical trial. **American Journal of Clinical Nutrition** 89(supp): 1588S-1596S.

Barnard ND, Katcher HI, Jenkins DJA, Cohen J, Turner-McGrievy G (2009b). Vegetarian and vegan diets in type 2 diabetes management. **Nutrition Reviews** 67(5): 255-263.

Barnard ND, Cohen J, Jenkins DJA, Turner-McGrievy G, Gloede L, Jaster B, Seidl K, Green AA, Talpers S (2006). A Low- Fat Vegan Diet Improves Glycemic Control and Cardiovascular Rick Factors in a Randomised Clinical Trial in Individuals With Type 2 Diabetes. **Diabetes Care** 29(8): 1777-1783.

Barnard ND, Scialli AR, Turner-McGrievy G, Lanou AJ (2004). Acceptability of a Low-fat Vegan Diet Compares Favorably to a Step II Diet in a Randomised, Controlled Trial. **Journal of Cardiopulmonary Rehabilitation** 24: 229-235.

Barnighausen T, Welz T, Hosegood V, Batzing-Feigenbaum J, Tanser F, Herbst K, Hill C, Newell ML (2008). Hiding in the shadows of the HIV epidemic: obesity and hypertension in a rural population with very high HIV prevalence in South Africa. **Journal of Human Hypertension** 22: 236-239.

Barr SI, Chapman GE (2002). Perceptions and practices of self- defined current vegetarian, former vegetarian, and nonvegetarian women. **Journal of the American Dietetic Association** 102(3): 354-360.

Basulto Marset J, Casas-Agustench P, Babio Sanchez N, Salas-Salvado J (2012). Knowledge, interest, predisposition and evaluation of functional foods in Spanish dietitians-nutritionists and experts in human nutrition and dietetics. **Nutricion Hospitalaria** 27: 632-644.

Bourne LT, Lambert EV, Steyn K (2002). Where does the black population of South Africa stand on the nutrition transition? **Public Health Nutrition** 5(1A): 157-162.

Braithwaite D, Emery J, de Lusignan S, Sutton S (2003). Using the Internet to conduct surveys of health professionals: a valid alternative? **Family Practice** 20(5): 545-551.

Bryman A, Bell E (2015). Business Research Methods. 4th Ed. Oxford, UK: Oxford University Press.

Buettner D (2017). The Blue Zone Website https://bluezones.com/recipes/food-guidelines/ (Accessed 15/11/2017).

Byham-Gray LD, Gilbride JA, Dixon LB, Stage FK (2005). Evidence- based practice: what are dietitians' perceptions, attitudes, and knowledge? **Journal of the American dietetic association** 105: 1574-1581.

Campbell K, Crawford D (2000). Management of obesity: attitudes and practices of Australian dietitians**. International Journal of Obesity** 24: 701-710.

Castro-Quezada I, Roamn-Vidas B, Serra-Majem L (2014). The Mediterranean diet and nutritional adequacy: A review. **Nutrients** 6: 231-248.

Chuan Ling AM, Horwath C (2001). Perceived Benefits and Barriers of Increased Fruit and Vegetable Consumption: Validation of a Decisional Balance Scale. **Journal of Nutrition Education** 33(5): 257-265.

Clarys P, Deliens T, Huybrechts I, Deriemaeker P, Vanaelst B, De Keyzer W, Hebbelinck M, Mullie P (2014). Comparison of Nutritional Quality of the Vegan, Vegetarian, Semi Vegetarian, Pesco- Vegetarian and Omnivorous Diet. **Nutrients** 6: 1318-1332.

Clarys P, Deriemaeker P, Huybrechts I, Hebbelinck M, Mullie P (2013). Dietary Pattern analysis: a comparison between matched vegetarian and omnivorous subjects. **Nutrition Journal** 12: 82.

Cox DN, Anderson AS, Lea MEJ, Mela DJ (1997). UK consumer attitudes, beliefs and barriers to increasing fruit and vegetable consumption. **Public Health Nutrition** 1(1): 61-68.

Craig WJ (2009). Health effects of vegan diets. **American Journal of Clinical Nutrition** 89(suppl): 1627S-1633S.

Cramer H, Kessler CS, Sundberg T, Leach MJ, Schumann D, Adams J, Lauche R (2017). Characteristics of Americans Choosing Vegetarian and Vegan Diets for Health Reasons. **Journal of Nutrition Education and Behavior** 49(7): 561-567.

Crittenden AN, Schnorr SL (2017). Current views on hunter-gatherer nutrition and the evolution of the human diet. **American Journal of Physical Anthropology** 162: 84-109.

Daffue Y (2017). HPCSA email correspondence, IT and statistical analysis.

Davis B, Melina V (2014). Becoming Vegan: Comprehensive Edition. Summertown, TN: Book Publishing Company.

de Oliveira Otto MC, Mozaffarian D, Kromhout D, Bertoni AG , Sibley CT, Jacobs Jr DR, Nettleton JA (2012). Dietary intake of saturated fat by food source and incident cardiovascular disease: the Multi- Ethnic Study of Atherosclerosis. **American Journal of Clinical Nutrition** 6(2): 397-404.

Dieticians Association of Australia. Vegetarian Diets- The Basics. https://daa.asn.au/smart eating-for-you/smart-eating-fast-facts/healthy-eating/vegetarian-diets-the-basics/ (Accessed 18/01/2017).

Draper A, Lewis J, Malhotra N, Wheeler E (1993). The energy and nutrient intakes of different types of vegetarian: a case for supplements? **British Journal of Nutrition** 69: 3-19.

Drimie S, Faber M, Vearey J, Nunez L (2013). Dietary diversity of formal and informal residents in Johannesburg, South Africa. **BMC Public Health** 13: 911.

Duncan K, Bergman EA (1999). Knowledge and Attitudes of Registered Dietitians Concerning Vegetarian Diets. **Nutrition Research** 19(12): 1741-1748.

Dunn-Emke SR, Weidner G, Pettengill EB, Marlin RO, Chi C, Ornish DM (2005). Nutrient Adequacy of a Very Low-Fat Vegan Diet. . **Journal of the American Dietetic Association** 105: 1442-1446.

Ecceles M, Grimshaw J, Walker A, Johnston M, Pitts N (2005). Changing the behaviour of healthcare professionals: the use of theory in promoting the uptake of research findings. **Journal of Clinical Epidemiology** 58: 107-112.

Evert AB, Boucher JL, Cypress M, Dunbar SA, Franz MJ, Mayer-Davis EJ, Neumiller JJ, Nwankwo R, Verdi CL, Urbanski P, Yancy WS (2014). Nutrition Therapy Recommendations for the Management of Adults with Diabetes. **Diabetes Care** 37(1): S120-S143.

Eysenbach G, Wyatt J (2002). Using the Internet for Surveys and Health Research. **Journal of medical Internet Research** 4(2): e13.

Faber M, Witten C, Drimie S (2011). Community- based agricultural interventions in the context of food and nutrition security in South Africa. **South African journal of clinical nutrition** 24(1): 24-30.

Farmer B, Larson BT, Fulgoni III VL, Rainville AJ, Liepa G (2011). A Vegetarian Dietary Pattern as a Nutrient-Dense Approach to Weight Management: An Analysis of the National Health and Nutrition Examination Survey 1999-2004. **Journal of the American Dietetic Association** 111: 819-827.

Foley G (2011). Can we feed the world and sustain the planet? **Scientific American** 60-65.

Fowler Jr FJ, Cosenza C (2008). Writing Effective Questions. In: De Leeuw ED, Hox JJ, Dillman DA. ed. International Handbook of Survey Methodology. New York, NY: Taylor & Francis Group, 136-160.

Fung TT, Schulze M, Manson JE, Willett WC, Hu FB (2004). Dietary Patterns, Meat Intake, and the Risk of Type 2 Diabetes in Women. **Archives of Internal Medicine** 164: 2235-2240.

Fung TT, Willett WC, Stampfer MJ, Mason JE, Hu FB (2001). Dietary Patterns and the Risk of Coronary Heart Disease in Women. **Archives of Internal Medicine** 161: 1857-1862.

Galhena DH, Freed R, Maredia KM (2013). Home gardens: a promising approach to enhance household food security and wellbeing. **Agriculture & Food Security** 2:8

Gliem J, Gliem R (2003). Calculating, Interpreting and Reporting Cronbach's Alpha Reliablility Coefficent for Likert-Type Scales. Paper presented at Midwest Research to Practice Conference in Adult, Continuing, and Community Education, 8-10 October 2003, Ohio State University, Columbus, OH, 82-88.

Graca J, Oliveira A, Calheiros MM (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. **Appetite** 90: 80-90.

Greger M (2016). How Not to Die. London, UK: Macmillan.

Hankey CR, Eley S, Leslie WS, Hunter CM, Lean MEJ (2003). Eating habits, beliefs, attitudes and knowledge among health preofessionals regarding the links between obesity, nutrition and health. **Public Health Nutrition** 7(2): 337-343.

Harland J, Garton L (2016). An update of the evidence relating to plant-based diets and cardiovascular disease, type 2 diabetes and overweight. **British Nutrition Foundation** 41: 323-338.

Hawkins IW, Balsam AL, Goldman R (2015). A survey of registered dietitians' concern and actions regarding climate change in the United States. **Frontiers in Nutrition** 2(21): 1-8.

Hayley A, Zinkiewicz L, Hardiman K (2015). Values, attitudes, and frequency of meat consumption. Predicting meat-reduced diet in Australians. **Appetite** 84: 98-106.

Hetherwick C, Neyman Morris M, Silliman K (2006). Perceived Knowledge, Attitudes, and Practices of California Dietitians Regarding Dietary Supplements. **Journal of the American Dietetic Association** 106: 438-442.

Hever J (2016). Plant-Based Diets: A Physicians Guide. **The Permanente Journal** 20(3): 93 100.

Hu FB, Rimm EB, Stampfer MJ, Ascherio A, Spiegelman D, Willett WC (2000). Prospective study of major dietary patterns and risk of coronary heart disease in men. **American Journal of Clinical Nutrition** 72: 912-921.

Hughes GJ, Kress KS, Armbrecht ES, Mukherjea R, Mattfeldt-Beman M (2014). Initial investigation of dietitian perception of plant-based protein quality. **Food science and nutrition** 2(4): 371-379.

Irish Nutrition and Dietietic Institute (2016). Eating Well on a Vegetarian Diet. Updated January 2016. https://www.indi.ie/fact-sheets/healthy-eating,-healthy-weight-and-dieting/506 eating well-on-a-vegetarian-diet.html (Accessed 18/01/2017).

James PT, Rigby N, Leach R (2003). The obesity epidemic, metabolic syndrome and future prevention strategies. **European Journal of Cardiovascular Prevention and Rehabilitation** 11(1): 3-8.

Johnstone JL, Fanzo JC, Cogill B (2014). Understanding sustainable diets: A descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. **Advance in Nutrition** 5: 418-429.

Joyce A, Dixon S, Comfort J, Hallett J (2012). Reducing the Environmental Impact of Dietary Choice: Perspectives from a Behavioural and Social Change Approach. **Journal of Environmental and Public Health** ID 978672: 1-7.

Kahleova H, Matoulek M, Malinska H, Oliyarnik O, Kazdova L, Neskudla T, Skoch A, Hajek M, Hill M, Kahle M, Pelikanova T (2010). Vegetarian diet improves insulin resistance and oxidative stress markers more than conventional diet in subjects with Type 2 diabetes. **Diabetes Medicine: a journal of the British Dietetic Association** 28: 549-559.

Kapur K, Kapur A, Ramachandran S, Mohan V, Aravind SR, Badgandi M, Srishyla MV (2008). Barriers to Changing Dietary Behaviour. **Journal of the Association of Physicians of India** 56: 27-32.

Key TJ, Fraser GE, Thorogood M, Appleby PN, Beral V, Reeves G, Burr ML, Chang-Claude J, Frentzel-Beyme R, Kuzma JW, Mann J, McPherson K (1999). Mortality in vegetarians and nonvegetarians: detailed findings from a collaborative analysis of 5 prospective studies. **American Journal of Clinical Nutrition** 70(suppl): 516S-524S.

Konner M, Boyd Eaton S (2010). Paleolithic Nutrition: Twenty-Five Years Later. **Nutrition in Clinical Practice** 25: 595-602.

Kruger HS, Puoane T, Senekal M, van der Merwe MT (2005). Obesity in South Africa: challenges for government and health professionals. **Public Health Nutrition** 8(5): 491-500.

Labadarios D, Steyn NP, Nel J (2011). How diverse is the diet of adult South Africans? **Nutrition Journal** 10:33.

Lajous M, Tondeur L, Fagherazzi G, de Lauzon-Guillain B, Boutron-Ruaualt MC, Clavel-Chapelon F (2012). Processed and Unprocessed Red Meat Consumption and Incident Type 2 Diabetes Among French Women. **Diabetes Care** 35: 128-130.

Lea EJ, Crawford D, Worsley A (2006a). Consumers' readiness to eat a plant-based diet. **European Journal of Clinical Nutrition** 60: 342- 351.

Lea EJ, Crawford D, Worsley A (2006b). Public Views of the benefits and barriers to the consumption of a plant-based diet**. European Journal of Clinical Nutrition** 60: 828-837.

Lea EJ, Worsley A (2003). The factors associated with the belief that vegetarian diets provide health benefits. **Asia Pacific Clinical Journal** 12(3): 296-303.

Lee V, McKay T, Ardern CI (2015). Awareness and Perception of Plant-Based Diets for the treatment and Management of type 2 diabetes in a community education clinic: A Pilot Study. **Journal of Nutrition and Metabolism** ID 236234: 1-6.

Leitzmann C (2014). Vegetarian nutrition: past, present, future. **American Journal of Clinical Nutrition** 100: 496-502.

Levin KA (2006). Study Design III: Cross-Sectional Studies. **Evidence-based Dentistry** 7:24 25.

Li D, Sinclair A, Mann N, Turner A, Ball M, Kelly F, Abedin L, Wilson A (1999). The association of diet and thrombotic risk factors in healthy male vegetarians and meat eaters. **European Journal of Clinical Nutrition** 53: 612-619.

Liu S, Manson JE, Lee IM, Cole SR, Hennekens CH, Willett WC, Buring JE (2000). Fruit and vegetable intake and risk of cardiovascular disease: the women's Health Study. **American Journal of Clinical Nutrition** 72: 922-928.

Liu S, Stampfer MJ, Hu FB, Giovannucci E, Rimm E, Manson JE, Hennekens CH, Willett WC (1999). Whole-grain consumption and the risk of coronary heart disease: results from the Nurses' Health Study. **American Journal of Clinical Nutrition** 70: 412-419.

Loughnan S, Bastian B, Haslam N (2014). The psychology of eating animals. **Current directions in psychological science** 23: 104-108.

Lutsey PL, Steffen LM, Stevens J (2008). Dietary intake and the Development of the Metabolic Syndrome: The Atherosclerosis Risk in Communities Study. **Circulation** 117: 754-761.

Macdiarmid JI, Kyle J, Horgen JW, Loe J, Fyfe C, Johnstone A, McNeill G (2012). Sustainable diets for the future: can we contribute to reducing greenhouse gas emissions by eating a healthy diet? **American Journal of Clinical Nutrition** 96: 632-639.

Maclellan DL, Gottschall-Pass K, Larsen R (2004). Fruit and Vegetable Consumption: Benefits and Barriers. **Canadian Journal of Dietetic Practice and Research** 65(3): 101-105.

Maimela E, Alberts M, Modjadji S, Choma S, Dikotape S, Ntuli T, Van Geertruyden JP (2016). The Prevalence and Determinants of Chronic Non-Communicable Disease Risk Factors amongst Adults in the Dikgale Health Demographic and Surveillance System (HDSS) Site, Limpopo Province of South Africa. **PLOS ONE** 11(2): 1-18.

Messina V, Melina V, Mangels AR (2003). A new food guide for North American Vegetarians. **Canadian journal of dietetic practice and research** 64(2): 82-86.

Marx W, Kiss N, McKavanagh D, Isenring E (2016). Attitudes, beliefs and behaviours of Australia dietitians regarding dietary supplements: A cross-sectional survey. **Complementary Therapies in Clinical Practice** 25: 87-91.

Mayosi BM, Flisher AJ, Lalloo UG, Sitas F, Tollman SM, Bradshaw D (2009). The burden of non-communicable diseases in South Africa. **Health in South Africa** 4: 1-14.

Mchiza ZJ, Steyn NP, Hill J, Kruger A, Schonfeldt H, Nel J, Wentzel-Viljoen E (2015). A review of dietary surveys in the adult South African population from 2000-2015. **Nutrients** 7: 8227-8250.

Melina V, Craig W, Levin S (2016). Position of the Academy of Nutrition and Dietetics: Vegetarian Diets. **Journal of the Academy of Nutrition and Dietetics** 116: 1970-1980.

Micklesfield LK, Lambert EV, Hume DJ, Chantler S, Pienaar PR, Dickie K, Puoane T, Goedeke JH (2013). Socio-cultural, environmental and behavioural determinants of obesity in black South African women. **Cardiovascular Journal of Africa** 24(9/10): 369- 375.

Naude CE (2013). " Eat plenty of vegetables and fruit everyday": a food-based dietary guideline for South Africa. **South African Journal of Clinical Nutrition** 26(3): 46-56.

Nestle M (1999). Animal versus plant foods in human diets and health: is the historical record unequivocal? **Proceedings of the Nutrition Society** 58: 211-218.

Newby PK, Tucker KL, Wolk A (2005). Risk of overweight and obesity among semivegetarian, lactovegetarian, and vegan women. **American Journal of Clinical Nutrition** 81: 1267 1274.

Nicholas LG, Pond CD, Roberts DCK (2003). Dietitian- general practitioner interface: a pilot study in what influences the provision of effective nutrition management. **American Journal of Clinical Nutrition** 77: 1039S- 1042S.

Noakes TD (2013). Low Carbohydrate and High fat can manage obesity and associated conditions: Occasional surveys. **South African Medical Journal** 103(11): 826-830.

Ogce F, Ceber E, Ekti R, Oran NT (2008). Comparison of Mediterranean, Western and Japanese Diets and Some Recommendations. **Asian Pacific Journal of Cancer Prevention** 9: 351-356.

Paterson M. 2006. Professional development of Dieticians completing compulsory community service in South Africa with special focus on KwaZulu-Natal. Doctor of Philosophy University of KwaZulu-Natal, Pietermaritzburg, South Africa.

Pillay S, Lutge E, Aldous C (2016). The burden of diabetes mellitus in KwaZulu- Natal's public sector: a 5 year prospective. **South African medical journal** 106(4): 384-388.

Pisa PT, Behannan R, Vorster HH, Kruger A (2012). Social drift of cardiovascular disease risk factors in Africans from the North West Province of South Africa: the PURE study. **Cardiovascular Journal of Africa** 23(7): 371-378.

Pollard J, Kirk SFL, Cade JE (2002). Factors affecting food choice in relation to fruit and vegetable intake: a review. **Nutrition Research Reviews** 15: 373-387.

Popkin B (2006). Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. **American Journal of Clinical Nutrition** 84: 289-298.

Popkin B (2003). The Nutrition Transition in the Developing World. **Development Policy Review** 21(5-6): 581-597.

Popkin B, Adair L, Wen Ng S (2012). Now and Then: The Global Nutrition Transition: The Pandemic of Obesity in Developing Countries. **Nutrition Review** 70(1): 3-21.

Pretorius S, Silwa K (2011). Perspectives and perceptions on the consumption of a healthy diet in Soweto, an urban African community in South Africa. **SA Heart** 8: 178-183.

Pribis P, Pencak RC, Grajales T (2010). Beliefs and attitudes toward vegetarian lifestyle across generations. **Nutrients** 2: 523-521.

Puoane T, Steyn K, Bradshaw D, Laubscher R, Fourie J, Lambert V, Mbananga N (2002). Obesity in South Africa: The South African Demographic and Health Survey. **Obesity Research** 10(10): 1038-1048.

Roberts P, Priest H, Traynor M (2006). Reliability and Validity in research. **Nursing Standard** 20(40): 41-45.

Sabaté J (2003). The contribution of vegetarian diets to health and disease: a paradigm shift? **American Journal of Clinical Nutrition** 78: 502-507.

Sans P, Combris P (2015). World meat consumption patterns: An overview of the last fifty years (1961-2011). **Meat Science** 109: 106-111.

Sartorius B, Veerman LJ, Manyema M, Chola L, Hofman K (2015). Determinants of Obesity and Associated Population Attributability, South Africa: Empirical Evidence from a National Panel Survey, 2008-2012. **Plos One** 10(6): 1-20.

Schmidhuber J, Shetty P (2005). The nutrition transition to 2030. Why developing countries are likely to bear the major burden. Paper presented at 97th Seminar of the European Association of Agricultural Economists, 21-22 April 2005, University of Reading, England, 1-26.

Schneider M, Bradshaw D, Steyn K, Norman R, Laubscher R (2009). Poverty and non communicable diseases in South Africa. Scandinavian **Journal of Public Health** 37: 176-186.

Schonfeldt HC, Pretorius B, Hall N (2013). "Fish, Chicken, lean meat and eggs can be eaten daily": a food-based dietary guideline for South Africa. **South African Journal of Clinical Nutrition** 26(3): 66-76.

Schösler H, de Boer J, Boersema JJ (2011). Can we cut out the meat of the dish? Constructing consumer-oriented pathways towards meat substitution. **Appetite** 58: 39-47.

Seguin R, Connor L, Nelson M, LaCroix A, Eldridge G (2014). Understanding barriers and facilitators to healthy eating and active living in rural communities. **Journal of Nutrition and Metabolism** 2014: 1-8.

Sharma SV, Gernand AD, Day RS (2008). Nutrition knowledge predicts eating beaviour of all food groups except fruits and vegetables among adults in the Paso del Norte region: Que Sabrosa Vida. **Journal of Nutrition Education and Behaviour** 40: 361-368.

Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Parker W, Maluleke T, Mchunu G, Naidoo P, Davids YD, Mokomane Z, Onoya D (2013). **The South African National Health and Nutrition Examination Survey SANHANES-1.** Cape Town: HSRC Press.

Simopoulos AP (2001). The Mediterranean Diets: What is so special about the diet of Greece? The scientific evidence. **The Journal of Nutrition** 131: 3065-3073.

Song Y, Mason JE, Buring JE, Liu S (2004). A Prospective Study of Red Meat Consumption and Type 2 Diabetes in Middle-Aged and Elderly Women. **Diabetes Care** 27: 2108- 2115.

Smith CF, Burke LE, Wing RR (2000). Vegetarian and Weight-Loss Diets among Young Adults. **Obesity Research** 8(2): 123-129.

Spencer EA, Appleby PN, Davey GK, Key TJ (2003). Diet and body mass index in 38 000 EPIC- Oxford meat-eaters, fish-eaters, vegetarians and vegans. **International Journal of Obesity** 27: 728-734.

Statistics South Africa (2017a). Causes of death 2013. http://www.statssa.gov.za/?page_id=737&id=3 (Accessed 24/04/2017).

Statistics South Afrcia (2017b). Mortality and causes of death in South Africa, 2015: finding from death notifications. Statistical release P0309.3.

Statistics South Africa (2017c). Quarterly labor force survey. Statistical Release PO211.

Statistics South Africa (2011). Census report https://census2011.adrianfrith.com/place/5 (Accessed 05/03/2018).

Stewart J, Manmathan G, Wilkinson P (2017). Primary prevention of cardiovascular disease: a review of contemporary guidance and literature. **Journal of the royal society of medicine cardiovascular disease** 6: 1-9.

Steyn NP, Labadarios D, Nel JH, Roberston H (2006). Development and Validation of a questionnaire to test knowledge and practices of dietitians regarding dietary supplements. **Nutrition** 21: 51-58.

Steyn NP, Nel JH, Parker W, Ayah R, Mbithe D (2012). Urbanisation and the nutrition transition: A comparison of diet and weight status of South African and Kenyan women. **Scandinavian Journal of Public Health** 40: 229-238.

Strategic Plan for the Prevention and Control of Non-Communicable Diseases 2013-17. Department of health South Africa.

Struwig FW, Stead GB (2001). **Planning, designing and reporting research.** Cape Town, SA: Pearson Education.

Tapsell LC (2017). Dietary behavior changes to improve nutritional quality and health outcomes. **Chronic Diseases and Traditional Medicine** 1-5.

Temple NJ, Steyn NP, Fourie J, De Villiers A (2011). Price and availability of healthy food: A study in rural South Africa. **Nutrition** 27(1): 55-58.

Terwee CB, Bot SDM, de Boer MR, Van Der Windt D, Knol DL, Dekker J, Bouter LM, de Vet HCW (2007). Quality Criteria were proposed for measurement properties of health status questionnaires. **Journal of Clinical Epidemiology** 60: 34-42.

Tonstad S, Butler T, Yan R, Fraser GE (2009). Type of Vegetarian Diet, Body Weight, and Prevalence of Type 2 Diabetes. **Diabetes Care** 32(5): 791-796.

Trapp C, Levin S (2012). Preparing to Prescribe Plant- Based Diets for Diabetes Prevention and Treatment. **Diabetes Spectrum** 25(1): 1-8.

Turner-McGrievy GM, Barnard ND, Scialli AR (2007). A two-year randomised weight loss trial comparing a vegan diet to a more moderate low fat diet. **Obesity** 15(9): 2276- 2281.

Turner-McGrievy GM, Davidson CR, Wingard EE, Wilcox S, Frongillo EA (2015). Comparative effectiveness of plant-based diets for weight loss: A randomised controlled trial of five different diets. **Nutrition** 31: 350-358.

United States Department of Agriculture (2015). Dietary Guidelines for Americans 2014-2020. Eighth Edition

Van Dam RM, Willett WC, Rimm EB, Stampfer MJ, Hu FB (2002). Dietary Fat and Meat Intake in Relation to Risk of Type 2 Diabetes in Men. **Diabetes Care** 25: 417-424.

Van Heerden A, Barnabus RV, Norris SA, Micklesfield LK, van Rooyen H, Celum C (2017). High prevalence of HIV and noncommunicable disease (NCD) risk factors in rural KwaZulu-Natal, South Africa. **Journal of the international AIDS society** 20:e25012.

Vang A, Singh PN, Lee JW, Haddad EH, Brinegar CH (2008). Meats, Processed Meats, Obesity, Weight Gain and Occurrence of Diabetes among Adults: Findings from the Adventist Health Studies. **Annals of Nutrition and Metabolism** 52: 96-104.

Van Zyl S, Van der Merwe L, Walsh C, Groenewald A, Van Rooyen F (2012). Risk-factor profiles for chronic disease of lifestyle and metabolic syndrome in an urban and rural setting in South Africa. **African Journal of Primary Health Care and Family Medicine** 4(1): 1-10.

Venter CS, Vorster HH, Ochse R, Swart R (2013). "Eat dry beans, split peas, lentils and soya regulary": a food- based dietary guideline. **South African Journal of Clinical Nutrition** 26(3): 36-45.

Vijan S, Stuart NS, Fitzgerald JT, Ronis DL, Hayward RA, Slater S, Hofer TP (2004). Barriers to following dietary recommendations in Type 2 diabetes. **Diabetic Medicine** 22: 32-38.

Visser J, Mackenzie A, Marais D (2012). Job satisfaction of South African registered dietitians. **South African Journal of Clinical Nutrition** 25(3): 112-119.

Vorster HH, Badham JB, Venter CS (2013). An introduction to the food-based dietary guidelines for South Africa. **South African Journal of Clinical Nutrition** 26(3): S1-S164.

Vorster HH, Kruger A, Margetts BM (2011). The Nutrition in Africa: Can It Be Steered into a More Positive Direction? **Nutrients** 3: 429-441.

Vorster HH (2013). Revised food-based dietary guidelines for South Africa: challenges pertaining to their testing, implementation and evaluation. **South African Journal of Clinical Nutrition** 26(3): 3-4.

Vorster HH, Wenhold FAM, Wright HH, Wentzel-Viljoen E, Venter CS, Vermmak M (2013). "Have milk, maas or yoghurt every day": A food- based dietary guideline for South Africa. **South African Journal of Clinical Nutrition** 26(3): 57-65.

Wentzel-Viljoen E (2016). The rules and competencies of the nutrition profession in the well being of the South African population. HPCSA: Professional board for dietetics and nutrition.

WHO (2018). World Health Organisation. Obesity and overweight. http://www.who.int/mediacentre/factsheets/fs311/en/ (Accessed 04/03/2017).

WHO (2017). World Health Organisation. Noncommunicable Diseases. http://www.who.int/mediacentre/factsheets/fs355/en/ (Accessed 04/05/2017).

WHO (2016). World Health Organisation. Obesity and Overweight. http://www.who.int/mediacentre/factsheets/fs311/en/ (Accessed 24/04/2017).

WHO (2015). World Health Organisation. Healthy Eating. http://www.who.int/mediacentre/factsheets/fs394/en/ (Accessed 27/07/2017).

WHO (2014). World Health Organisation. Global status report on noncommunicable diseases. http://www.who.int/nmh/publications/ncd-status-report-2014/en/ (Accessed 24/04/2017).

Willcox C, Willcox B, Todoriki H, Suzuki M (2009). The Okinawan Diet: Health implications of a low-calorie, nutrient-dense, antioxidant-rich dietary pattern low in glycemic load. **Journal of the American College of Nutrition** 28(4): 500S-516S.

Worsley T (2002). Nutrition knowledge and food consumption: can nutrition knowledge change food behavior? **Asia Pacific Journal of Clinical Nutrition** 11(suppl): S579-S585.

Wright N, Wilson L, Smith M, Duncan B, McHugh P (2017). The BROAD study: A randomised controlled trial using a whole food- plant based diet in the community for obesity, ischaemic heart disease or diabetes. **Nutrition and Diabetes** 7: 1-10.

APPENDIX A: Questionnaire

SECTION A: DEMOGRAPHIC CHARACTERISTICS

1. Age _____

2. Gender

Female	
Male	

3. Race

Black	
Coloured	
Indian	
White	
Other: Specify _____	

4. In what year did you start working as a registered dietician? ……

5. Where did you obtain your qualification? (Select **ONE** option only)

University of Cape Town		University of Pretoria	
University of Free State		Sefako Makghato Health Services	
University of KwaZulu-Natal		University of Stellenbosch	
University of Limpopo (Turfloop Campus)		University of Western Cape	
Nelson Mandela Metropolitan University		Outside RSA	
North-West University (Potchefstroom Campus)		Other	

If you stated ‘other’, please specify _____

6. What is your highest qualification to date?

Bachelor’s Degree	
Post-graduate diploma	
Honours	
Masters	
PhD	
Other	

If you stated ‘other’ please specify ……

7. In what sector are you currently employed (Tick all that apply)

7.1 Government	
7.2 Private	
7.3 Other	

If you stated ‘other’ please specify ……..

8.1 Rate from 1 to 5 how frequently ADULT patients visit you or are referred to you because of the following reasons. [1 = not at all frequently to 5 = very frequently]

Reason	Frequency rating
8.1.1 Cancer	
8.1.2 Chronic Disease of Lifestyle	
8.1.3 Disorders of the GIT	
8.1.4 HIV/AIDS and TB	
8.1.5 Liver Disease	
8.1.6 Renal Disease	
8.1.7 Sports Nutrition	
8.1.8 Other	

If you stated ‘other’ please specify ……

8.2 Rate from 1 to 5 how frequently PAEDIATRIC patients visit you or are referred to you because of the following reasons. [1 = not at all frequently to 5 = very frequently]

Reason	Frequency rating
8.2.1 Cancer	
8.2.2 Chronic Disease of Lifestyle	
8.2.3 Disorders of the GIT	
8.2.4 HIV/AIDS and TB	
8.2.5 Liver Disease	
8.2.6 Renal Disease	
8.2.7 Sports Nutrition	
8.2.8 Other	

If you stated ‘other’ please specify ……

SECTION B: OPINION OF A PLANT BASED DIET

1. Are you familiar with the term "Vegan Diet?"

Yes	No

If you answered 'no', please proceed to question 4. If you answered 'yes', please continue. (This was done automatically on the online survey)

2. In your opinion, which of the following best describes a Vegan diet? (Select **ONE** option only)

A diet that is free from red meat but may contain fish, chicken, eggs and dairy.	
A diet that contains some animal by-products such as egg and dairy.	
A diet that excludes meat, poultry, fish, dairy products, eggs, gelatin, and other foods of animal origin.	

3. Indicate your agreement that a Vegan diet can be nutritionally complete.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

4. Are you familiar with the term "Whole Foods Plant Based Diet?"

Yes	No

If you answered 'no' please proceed to section C. If you answered 'yes', please continue. (This was done automatically on the online survey)

5. Please indicate which of the following from the list below you would consider to be minimally processed whole plant based foods (you may choose as many as you feel are appropriate).

5.1 Eggs	
5.2 Vegetables	
5.3 Fresh Fruit	
5.4 Dried Fruit	
5.5 Nuts and Seeds	
5.6 Dairy (Milk, cheese, yoghurt)	
5.7 Soya Milk	
5.8 Legumes	
5.9 Chicken	
5.10 Whole Grains	
5.11 Red Meat	
5.12 Fish	
5.13 Processed Soya meat alternatives	
5.14 Natural nut butters	
5.15 Coconut/ Olive oil	
5.16 Sunflower Oil	
5.17 Honey	
5.18 Stevia	

6. Indicate your agreement that a Vegan diet that is made up exclusively of minimally processed whole plant based foods can be nutritionally adequate.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

7. Indicate your agreement with the following statements:

	Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.1	I was well-trained in the use of whole food plant based vegan diets at University.					
7.2	I am interested in improving my knowledge on whole food plant based vegan diets.					
7.3	I am competent enough to compose a whole foods plant based vegan diet plan.					
7.4	I would consume a whole foods plant based vegan diet if there was strong evidence in support of the benefits of this diet.					

8. Rate the frequency (from 1 to 5) with which you recommend a whole foods plant based vegan diet to your patients when it is appropriate. [1 = never to 5 = always].

Frequency rating: _____

9. If you are interested in learning more about whole food plant based vegan diets, what websites would you use to find more information on the topic?

_____

_____

_____

SECTION C:

For the purpose of the next two sections please use the table attached as a guide to a whole food plant based vegan diet.

THE PERCEIVED BENEFITS OF A WHOLE FOODS PLANT BASED VEGAN DIET

Indicate the extent to which you agree that the following are benefits of following a whole foods plant based vegan diet:

	Benefits of following a whole foods plant based vegan diet	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	It reduces the risk of diseases of lifestyle.					
2.	It encourages the consumption of a greater variety of foods.					
3.	It encourages a lower saturated fat intake due to reduced animal products.					
4.	It is associated with a lower cholesterol intake.					
5.	It is associated with improved fibre intake.					
6.	It is associated with reduced risk of constipation.					
7.	It encourages an increased consumption of vitamins and minerals.					
8.	It is an easy diet to follow.					
9.	It improves energy levels.					
10.	Meals are quick to prepare.					
11.	It is affordable.					
12.	It is a suitable option in low-income households.					

SECTION D: PERCEIVED BARRIERS OF A WHOLE FOODS PLANT BASED VEGAN DIET

Indicate the extent to which you agree with the following statements regarding a whole foods plant based vegan diet:

	Barriers of following a whole foods plant based vegan diet	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
1.	There is not enough information about the diet.					
2.	People prefer to consume meat and animal by-products.					
3.	There is not enough protein in the diet.					
4.	The diet is not filling enough.					
5.	The diet may cause indigestion, bloating, gas or flatulence.					
6.	The diet lacks variety.					
7.	The meals are difficult to prepare.					
8.	The diet is difficult to follow in social settings.					
9.	There is resistance from friends and family to follow the diet.					
10.	Ready to eat plant based vegan meals and snacks are not easily accessible.					
11.	There is not enough awareness around whole food plant based vegan diets for the public.					

THANK YOU FOR YOUR PARTICIPATION.

WFPBVD Table (This was attached to Section C and Section D)

Vegetables	Fresh Vegetables Starchy Vegetables Freshly pressed vegetable juices
Fruit	All fresh fruit Dried Fruit Frozen Fruit Freshly squeezed fruit juice
Legumes	Chickpeas, Lentils, Beans (all types) Peas Tofu
Whole Grains	Quinoa Barley Brown Rice Buckwheat Millet Wild Rice Couscous Oats Popcorn Rye Corn
Nuts and Seeds	All raw, unsalted nuts and seeds Natural nut butters Flax Seeds Chia Seeds
Fats and Oils	Coconut oil Olive Oil Olives Avocado
Sweeteners	Stevia Xylitol

APPENDIX B: Ethical clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

11 July 2017

Ms LM Van Rensburg (207516452)
Discipline of Dietetics and Human Nutrition
School of Agriculture, Earth and Environmental Sciences
SAEES
Lauramay87@yahoo.com

Dear Ms Van Rensburg

Protocol: The opinion of KwaZulu-Natal dieticians regarding the perceived benefits and barriers toward consumption of a whole-foods plant based vegan diet. Degree: MSc
BREC ref: BE289/17

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 11 May 2017.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 04 July 2017 to BREC letter dated 21 June 2017 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given **full ethics approval** and may begin as from 11 July 2017.

This approval is valid for one year from **11 July 2017.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure **safety** of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be RATIFIED by a full Committee at its next meeting taking place on 08 August 2017.

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor V Rambiritch
Deputy Chair: Biomedical Research Ethics Committee

cc supervisor: wiesN@ukzn.ac.za
cc: Postgraduate Office: Marsha Manjoo

APPENDIX C: Gatekeepers permission

ADSA association for dietetics in south africa

6 / 7 / 2017

Dear Ms Laura Janse Van Rensburg

Re: Approval of a Research Proposal

Your MSc (Dietetics) research project entitled "The opinion on KwaZulu-Natal Dieticians' towards the perceived benefits and barriers of a whole foods plant based vegan diet" was reviewed.

Permission is granted for your research to be conducted among private practicing and government employed dieticians who are registered with Association for Dieticians in South Africa (ADSA).

This permission is granted on the basis that the following is noted:

a. You will not have primary access to the member database.

b. Questionnaires can be forwarded to KZN dieticians directly using the ADSA mailer.

For any additional information please contact ADSA membership on adsamembers@gmail.com

Kind regards,

Kerry-Ann Dolloway RD(SA)
Association for Dietetics South Africa (ADSA)
Executive Portfolio Holder - Membership
www.adsa.org.za

APPENDIX D: Consent information sheet

Discipline of Dietetics and Human Nutrition

University of KwaZulu- Natal

Pietermaritzburg Campus

PARTICIPANT INFORMATION AND INFORMED CONSENT

Dear Dietician

My name is Laura Janse Van Rensburg and I am currently enrolled as a Masters Student at the University of KwaZulu-Natal Pietermaritzburg, South Africa.

You are being invited to consider participating in a research study to determine your opinion toward the perceived benefits and barriers of a whole-foods plant-based vegan diet (WFPBVD). The objectives of the study are to determine the following:

- The dieticians demographics
- The dieticians opinion of a WFPBVD
- The dieticians perceived benefits of a WFPBVD
- The dieticians perceived barriers of a WFPBVD

The study is expected to enroll all KZN private and government employed ADSA dieticians that are in contact with clients and patients. It will involve the use of an online questionnaire that will only be completed once. All the information obtained will be kept confidential.

Internationally, plant based vegan diets have been extensively researched and have shown positive results as a treatment option for diseases of lifestyle. This topic is yet to be explored in South African literature and for this reason the hopes of this study is to bring plant based vegan diets to the attention of KwaZulu- Natal dieticians.

This study has been ethically reviewed and approved by the UKZN Biomedical research Ethics Committee (BREC Ref: BE 289/17).

In the event of any problems/ concerns/ questions you may contact my research supervisor Dr Nicola Wiles or the Biomedical Research Ethics Committee.

Contact Details

Research Supervisor: Dr Nicola Wiles

Email: wilesn@ukzn.ac.za

Number: 033 260 5430

Researcher: Laura Janse Van Rensburg

Email: lauramay87@yahoo.com

Number: 074 405 8192

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za

Participation in this research is voluntary and you may withdraw participation at any point. The event of refusal/withdrawal of participation will not have any negative effect on you. All answers will be kept anonymous and will not be shared with any third party without your signed consent.

In order to maintain confidentiality, all personal data will be used solely for the purpose of the study and will not be disclosed to the public. No names will be used when drawing conclusions and/or writing up results. The results of the study will be submitted for publication in a journal.

Kind Regards

Laura Janse Van Rensburg RD (SA)

APPENDIX E: Declaration of understanding

DECLARATION

By giving my assent to participate in the study by clicking on the survey link provided, I agree to take part in the research study entitled: The opinion of KwaZulu-Natal dieticians regarding the perceived benefits and barriers toward the consumption of a whole-foods plant based vegan diet.

I declare that:

- I understand the purpose and procedures of the study
- I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.
- I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without prejudice.
- If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at the email lauramay87@yahoo.com
- If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus

Govan Mbeki Building

Private Bag X 54001
Durban
4000

KwaZulu-Natal, SOUTH AFRICA

Tel: 27 31 2604769 - Fax: 27 31 2604609

Email: BREC@ukzn.ac.za